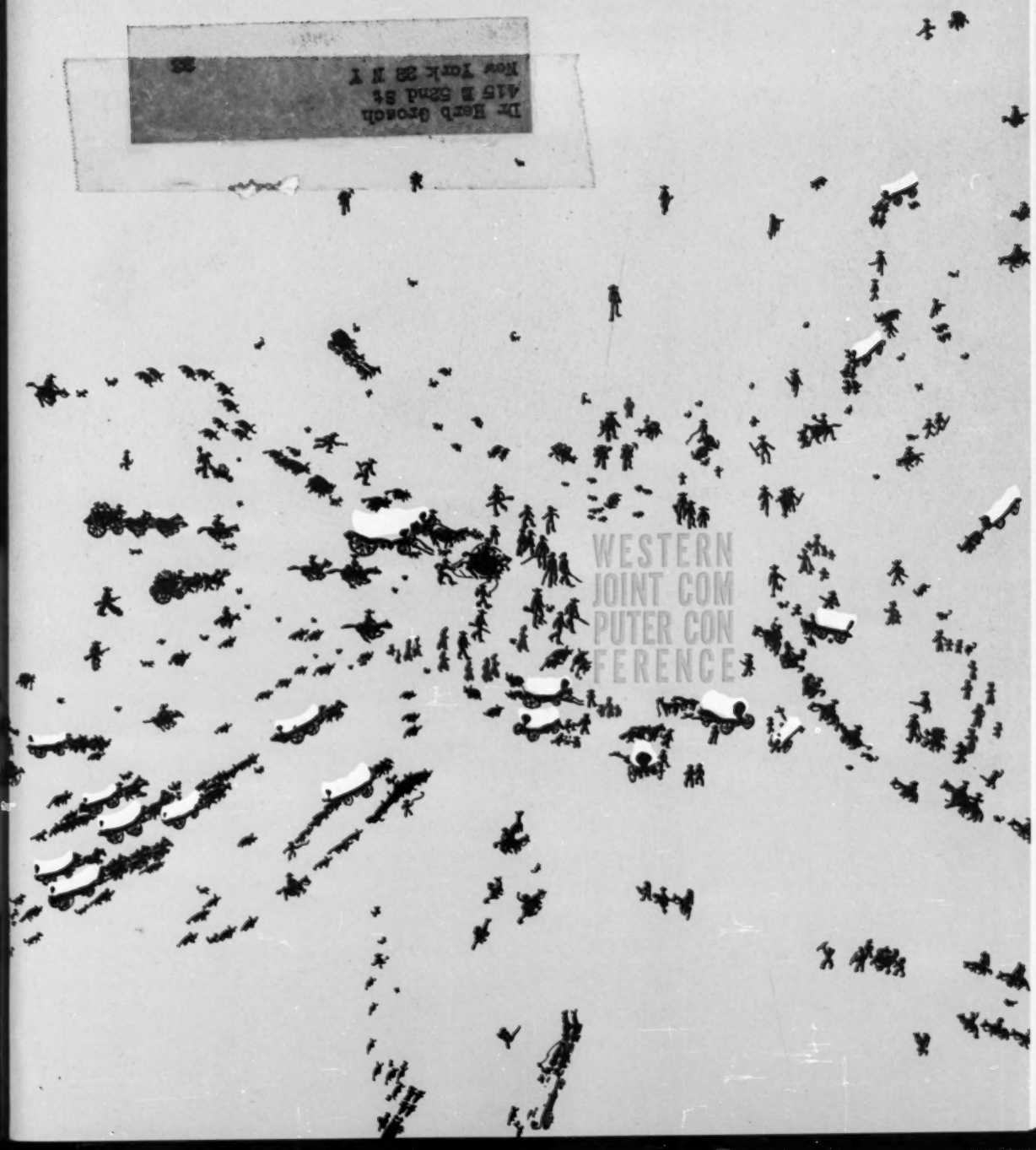
DATAMATION

61

April

Dr Herb Grosch
415 E 52nd St
New York 22 N Y
22



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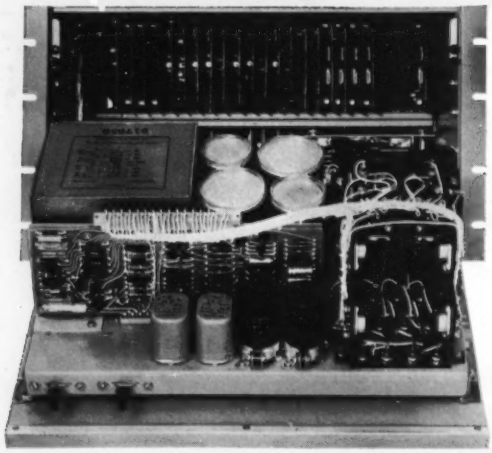
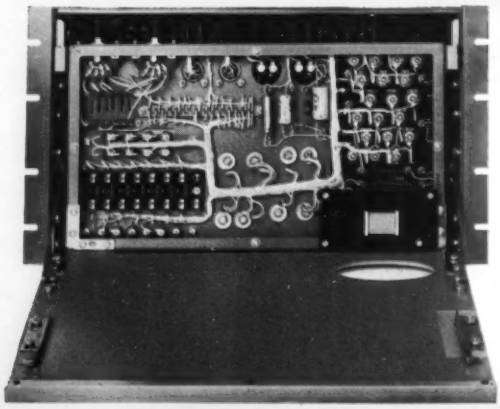
REMEMBER WHEN CORE MEMORIES LOOKED LIKE WAR SURPLUS?

MOST OF THEM STILL DO–BUT NOT THE AMPEX RB. IT'S SMALL . . . FITS NEATLY IN 10½" OF RACK SPACE. IT'S FAST . . . LOAD OR UNLOAD IN 5 MICROSECONDS, COMPLETE MEMORY CYCLE IN 8 MICROSECONDS. IT REMEMBERS . . . UP TO 1024 WORDS, 4 TO 24 BITS PER WORD. AND TOO, THE NEW AMPEX RB LOOKS LIKE WHAT IT IS: A PRODUCT OF THE COMPANY THAT PIONEERED CORE MEMORIES (FORMERLY TELEMETER MAGNETICS INC.).



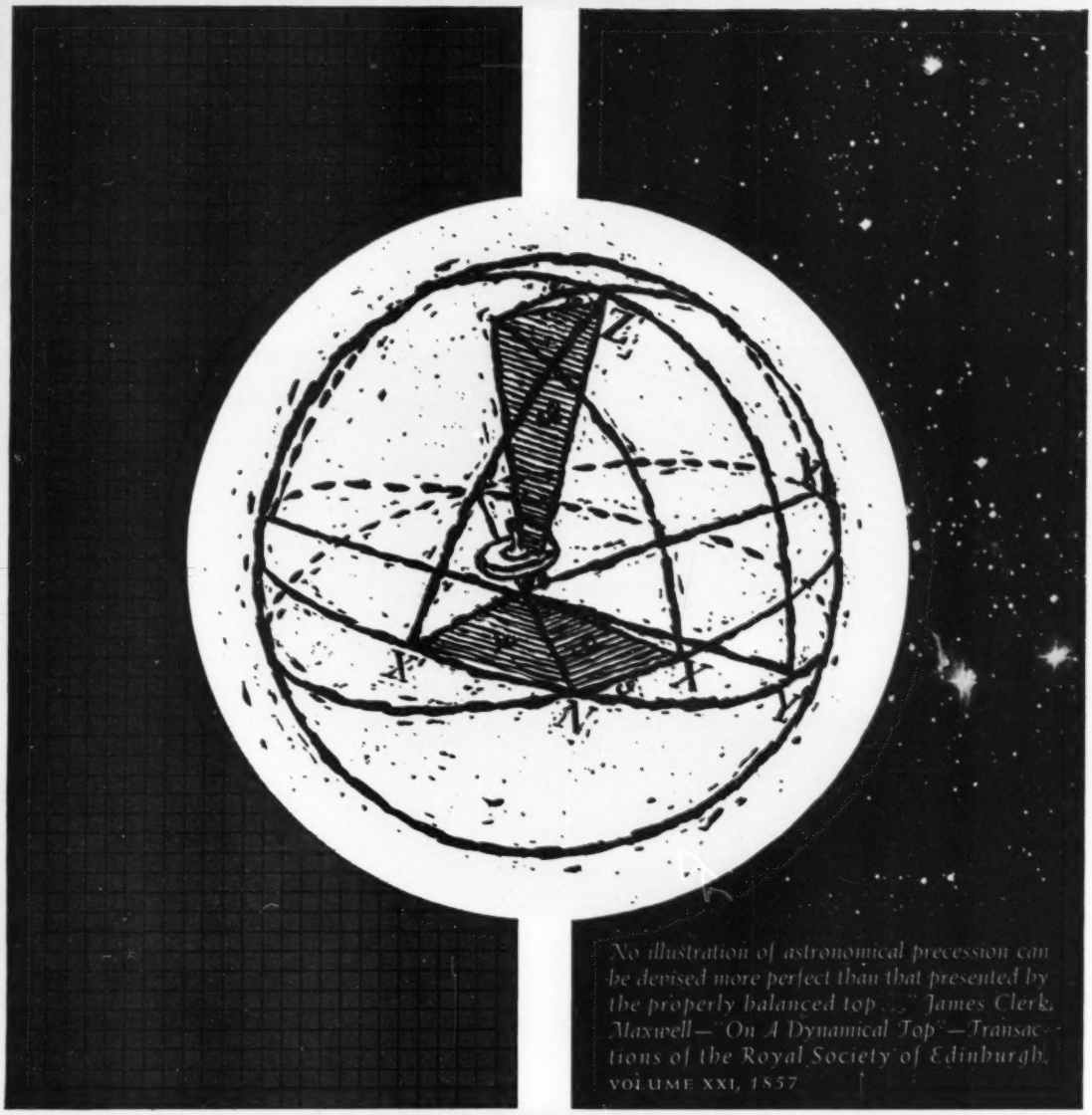
BUT THERE'S MORE THAN BEAUTY BEHIND THE MODERN, SWING-DOWN FRONT PANEL . . . INSPECTION, MAINTENANCE, AND REPLACEMENT IS ACCOMPLISHED FROM THE FRONT . . . EVERY COMPONENT, EACH CIRCUIT, IS LITERALLY AT YOUR FINGERTIPS ALMOST INSTANTLY. WANT MORE INFORMATION ABOUT THE NEW LOOK IN CORE MEMORIES? WRITE: CORE MEMORY DIVISION, AMPEX COMPUTER PRODUCTS CO., P.O. BOX 329, CULVER CITY, CALIF.

AMPEX 0/1 T.M.
AMPEX COMPUTER PRODUCTS COMPANY



CIRCLE 49 ON READER CARD

Senior mathematicians for **S**pace **T**echnology **L**eadership


Z
X
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N
No illustration of astronomical precession can be devised more perfect than that presented by the properly balanced top . . . James Clerk Maxwell— *On A Dynamical Top*—Transactions of the Royal Society of Edinburgh, VOLUME XXI, 1857

REPRINTS OF THE DRAWINGS CREATED FOR THIS SERIES, SUITABLE FOR FRAMING, ARE AVAILABLE ON REQUEST.

Through the centuries, the dynamical top, a toy of their youth, fascinated such men as Euler, D'Alembert, Lagrange, and Maxwell. It aided them in discovering laws regarding the rotation of bodies and in relating the phenomenon to mechanics. Today these laws serve as a springboard for the mathematician concerned with the advancement of space technology. The senior mathematician whose abilities exceed the challenge of his present assignment will find at Space Technology Laboratories, Inc. opportunity to explore and develop new areas of Space Technology Leadership. Your inquiry will be welcomed and will receive our meticulous attention.

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$\Diamond_{ij} \sum_1^n \{\Psi_i + \Delta, * \oplus\} \simeq \in \Lambda_{(\mathrm{eval})} \beta LA_j \leq P_n \Phi \cdots$ end

$\cdots$ WHAT NEXT . : ⋮ ⋮ ⤷

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DATAMATION 61

the automatic handling of information

volume 7, number **4**

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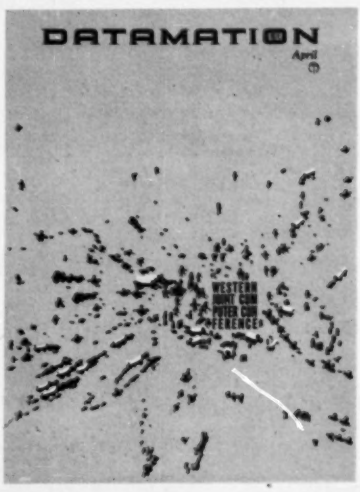
THIS ISSUE — 37,000 COPIES



Cover

DATAMATION staff artist (and managing editor-elect), Miss Cleve Boutell, went Western in a big way on this month's cover. Of course we aren't suggesting that conference attendees come to the WJCC in covered wagons but the old saw says anything can happen in Los Angeles . . .

Circulation audited by Business Publications Audit — BPA

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DATAMATION is published monthly on or about the tenth day of every month by F. D. Thompson Publications, Inc., Frank D. Thompson, president. Executive Circulation and Advertising offices, 141 East 44th St., New York 17, N.Y. (MUrray Hill 7-5180). Editorial offices, 10373 West Pico Blvd., Los Angeles 64, Calif. (BRadshaw 2-0817). Published at Chicago, Ill. Application applied for controlled circulation publication at Columbus, O.

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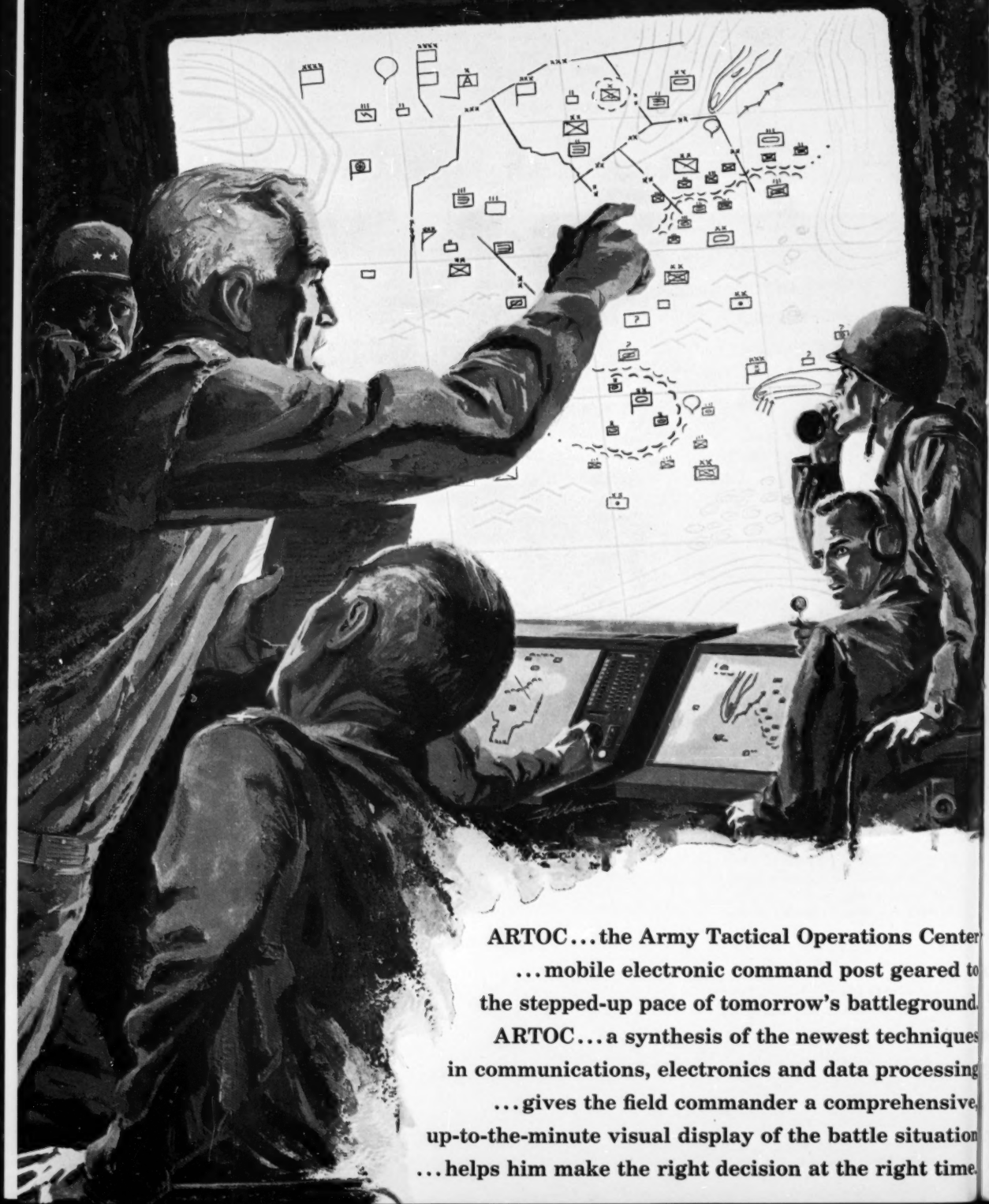
THE COMMANDER'S ELECTRONIC ASSISTANT



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CIRCLE 1 ON READER CARD

to the editor . . .

Dear Sir:

The February issue of DATAMATION contains an item about the rescheduled delivery date of STRETCH to the Los Alamos Scientific Laboratory. In this item you used several quotations from me which I feel were unfair to IBM and STRETCH, inasmuch as the statements were a reflection of the conditions in December, when the telephone conversation took place, but certainly not in February when they were published.

Since the conversation with DATAMATION in December, the situation has changed markedly. For the past month, STRETCH has worked reliably and very well, not only on IBM diagnostic routines but also on Los Alamos production codes.

I no longer feel that April 1 is an optimistic delivery date, since the performance and reliability of STRETCH has improved steadily over the last month. Formal reliability and performance tests will take place in Poughkeepsie during March on LASL problems for pre-shipment acceptance.

The speed of the computer is not likely to come up to our expectations of two years ago. STRETCH is still, however, a very powerful computer, and in my opinion, the most powerful that is likely to appear for several years. We are eager to get it to Los Alamos, where we have a heavy work load waiting for it.

In view of the new situation since December, I will appreciate it if you will make appropriate use of my present feelings to erase the negative impression that we were not satisfied with STRETCH in February.

Mr. Bengt Carlson
University of California
Los Alamos Scientific Laboratory

Editor's Note – To set the record straight, we must point out that our notes, backed up by Pacific Telephone Co. records, show that DATAMATION interviewed Mr. Carlson on January 17, 1961, exactly five weeks before the magazine was in the hands of readers.

IF YOU'RE GOING TO BUY COMPUTER TIME, IT WILL PAY YOU TO USE THE BEST

Here's how to put the efficient new IBM 7090 computer to work for you . . . at less cost than you may have thought possible.

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You will find the savings considerable.

In addition to the 7090, the following services are provided without charge:

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Here's all you do: for full details on the new IBM 7090 Data Processing Center, (the only one of its kind in New England) just write:

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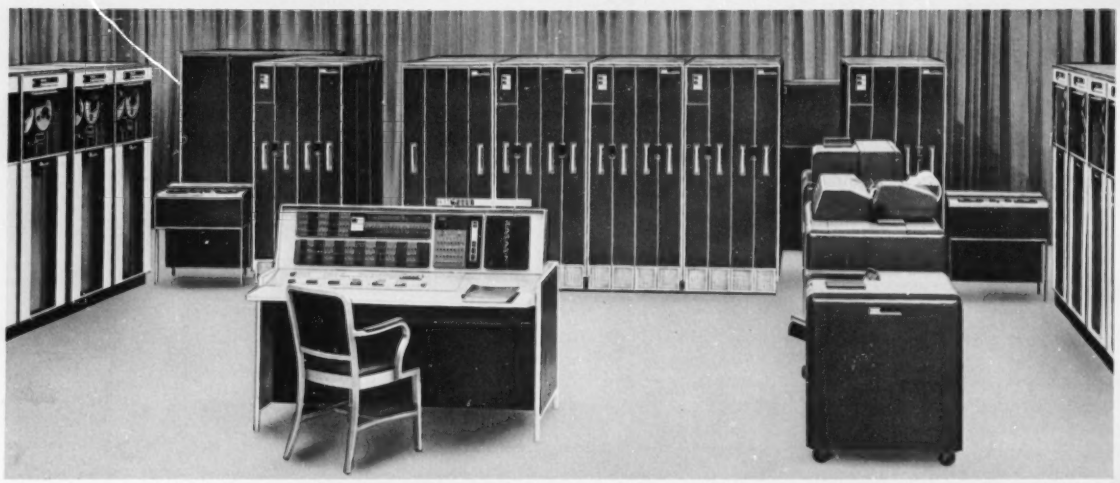

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CSI's staff of programming and operational personnel, with extensive experience on the IBM 704 and 709 computers, will insure your efficient use of this Data Processing Center.

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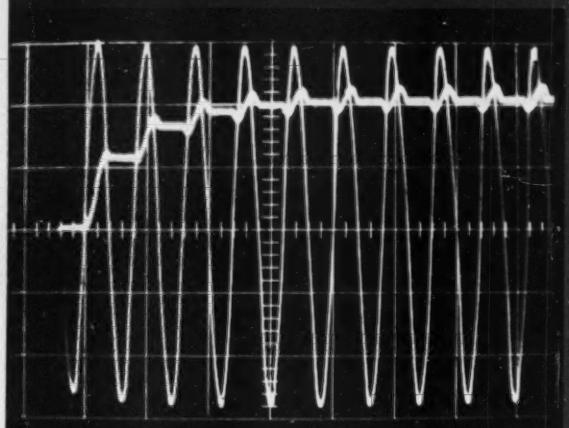
AC MEASUREMENT

FAST AND PRECISE



FAST ACQUISITION

Superimposed input and output waveforms show the fast response time of Adage's Type ACS1 AC Averager. Short filter time constant allows the steady state value to be achieved quickly.

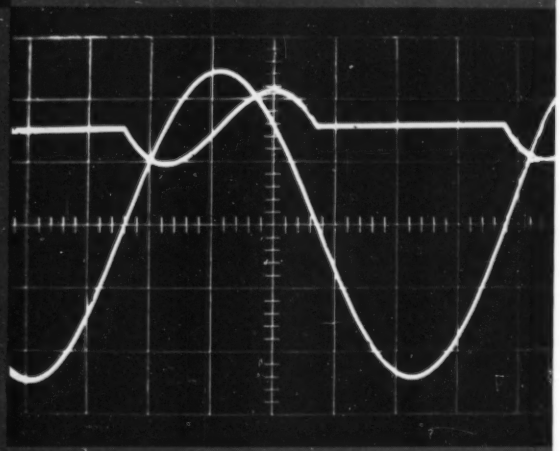
PRECISE MEASUREMENT

The ripple present in the output waveform does not interfere with the precision of the measurement. Timing circuitry insures that the voltage measured is that value present during the interval when the output is ripple free.

Modern instrumentation systems demand equipment to make fast, precise measurements of AC signal waveforms. This required combination of speed and accuracy is beyond the capability of conventional techniques. For example, a conventional diode-capacitor AC/DC converter requires at least three seconds settling time to make 60 cps measurements. When many different signal sources must be scanned and measured successively, this slow response time limits seriously the overall system speed.

Slow response time is also a disadvantage in AC carrier systems. The transformer-driven diode bridge demodulators conventionally used as phase-sensitive AC measurement instrumentation for these systems have inherent limitations in both speed and accuracy. They tend to compromise the performance of instrumentation systems using them.

There has been, then, a clear need for innovation in the field of AC measurement. Responding to this need, Adage has developed several new AC measurement techniques. Among these is the fast-averaging technique illustrated in the accompanying waveform photographs. This technique offers substantially improved performance both for self-synchronous and phase-sensitive measurements. Response time, for example, is improved by more than a factor of ten to one. Used in conjunction with precision voltage to digital converters, modules implementing these new measurement methods have been successfully applied in many industrial and military instrumentation systems. A typical solid-state, AC Signal Conditioner is comprised of three 5″ x 8″ epoxy fibreglass circuit modules, easily incorporated in any of the Adage VOLDICON® voltage to digital converters.



Applications notes and technical data describing in detail Adage's AC instrumentation capability is available upon request.

Adage INC

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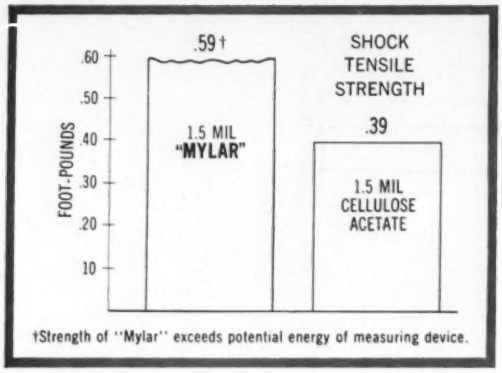
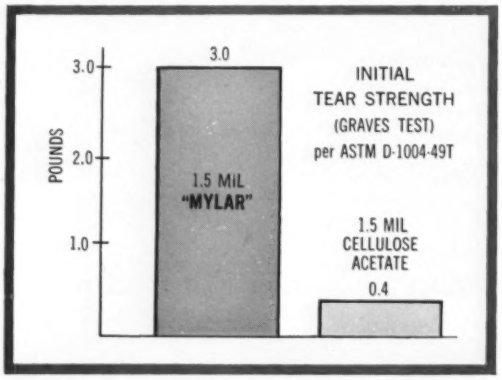
CIRCLE 3 ON READER CARD

GUARD AGAINST DOWNTIME WITH RELIABLE TAPES OF MYLAR®



†Strength of "Mylar" exceeds potential energy of measuring device.



Every minute of downtime costs you dollars. That's why the reliability of your magnetic tape is so important. Tapes of Mylar*, resist breaking from sudden starts and stops since they have high shock-tensile strength . . . and they have 7 times the initial tear strength of acetate tapes.

"Mylar" adds to the reliability of playback. It resists the cupping, swelling and shrinking which can reduce intimate head contact and cause read/write errors. Age, storage conditions and repeated playbacks won't affect "Mylar" either.

The cost of the data . . . the cost of the equipment . . . the cost of time *all* demand reliability. Get it with tapes of "Mylar". Send coupon for free booklet of comparative test data and judge for yourself. Du Pont Company, Film Department, Wilmington 98, Delaware.

*Du Pont's registered trademark for its polyester film.

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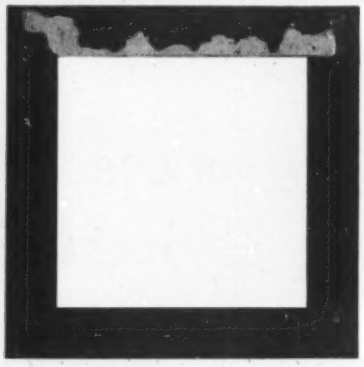
Company_____

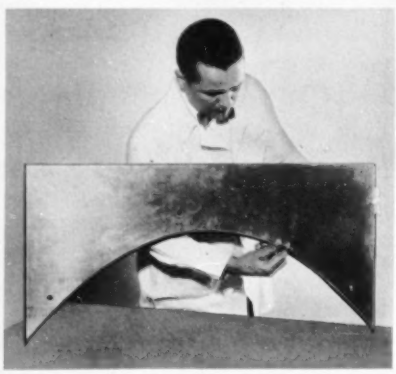
Address_____

City_____ Zone____ State_____

CIRCLE 4 ON READER CARD

Automatic drafting from computer logic recorded on microfilm like this actual sample in 1/2 second by the S-C 4020 Microfilm Recorder





This microfilm sample was produced by the General Dynamics/Electronics S-C 4020 Microfilm Recorder. It makes possible an important new application for most major computers.

Using APT (Automatically Programmed Tool) language, the computer programmer converts any drawing configuration into computer format. The computer then operates the S-C 4020 which makes instantaneous, multi-view mechanical drawings of the part, including dimensions, tolerances and other essential data. Once these drawings have been checked, output of the computer can be used to operate a numerical control tool and produce the part. In addition to automatic drafting, the S-C 4020 can be utilized as a computer printer, recording data at 6000 lines per minute, or as a graph plotter, recording highly-accurate curves at 12,500 points per second. First demonstration of this new automatic drafting application will be at WJCC, May 9 through 11. Write for details to General Dynamics/Electronics, Information Technology Division, Dept. B-26, P.O. Box 2449, San Diego 12, California.

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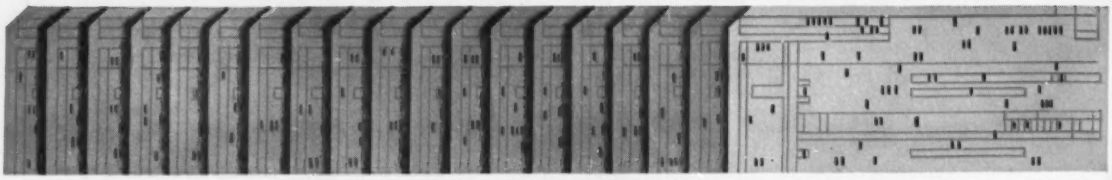
INFORMATION TECHNOLOGY DIVISION

a DATA-PHONE case history

Biggest DATA-PHONE *system*



in the United States today!

A midwestern insurance company sets a dramatic example for users of data-processing equipment

The Hardware Mutuals - Sentry Life insurance group is using a new data-communications system to speed data handling by 500 per cent and reduce operating costs by over a million dollars a year.

The new system makes use of the nationwide Long Distance telephone network. It combines the Bell System's new *Data-Phone* service with data processing equipment to send business records from 32 branches to the company's centralized computer center at Stevens Point, Wisconsin.

Machines "talk" to machines

All kinds of daily operating data, from widely scattered points, are handled efficiently and accurately at speeds up to 200 words per minute. The data is keyed into punch cards. A Data-Phone unit is connected to business machines at both the sending and receiving locations. A phone call is put through—and the machines immediately start "talking" data. It's that simple.

The system is as flexible as the telephone network itself. The insurance company pays for telephone circuits only when using them, as for any branch-to-headquarters call. And Data-Phone takes up little more space than a standard typewriter.

• • •

Learn how high-speed, low-cost Data-Phone service can streamline your company's data processing. Just call your Bell Telephone Business Office and ask for a Communications Consultant. He'll bring you the complete story.

James P. Jacobs, President, Hardware Mutuals - Sentry Life insurance group, says:

"Our new data-processing technique—with the rapid communication of data made possible by Data-Phone—is benefiting our business in many important ways.

"It lets us collect the mass of information we need for management decisions almost instantly. It has cut the time needed for certain policy-handling functions from three days to three minutes. It is reducing our operating costs by over $1,000,000 a year and is helping us give our policyholders better service than ever before.

"Naturally, we're enthusiastic about it."

The one source for all business communications

BELL TELEPHONE SYSTEM

CIRCLE 6 ON READER CARD

CODASYL SAYS NO ONE OFF COBOL TEAM

On the COBOL front, Charles Phillips, chairman of CODASYL's executive committee, told DATAMATION last month that his group isn't mad at anyone. Phillips asserts that no manufacturer or user has been told to fish or cut bait COBOL-wise. He also said that evolutionary improvements were made in the transition from COBOL 60 to COBOL 61. He mentioned, specifically, a change in concept in the data division. Walter W. Finke, president of Minneapolis-Honeywell's EDP Div., also told this magazine that contrary to reports being circulated, his firm and CODASYL had not severed contact. Although Honeywell representatives have been quite openly less than wild about COBOL development, Finke says his firm will implement the '61 version for the H-800 and H-400 systems.

Meanwhile, Phillips had something to say about the possibility of the COBOL effort being sponsored by the Data Processing Group of OEMI. "When the OEMI adopts COBOL as the common business language, then they will be in a better position to talk about monitoring the effort," he said. Phillips added, however, that chances are very good for the OEMI approach to sponsorship.

NEW PLAN FOR CONFERENCE SWITCH

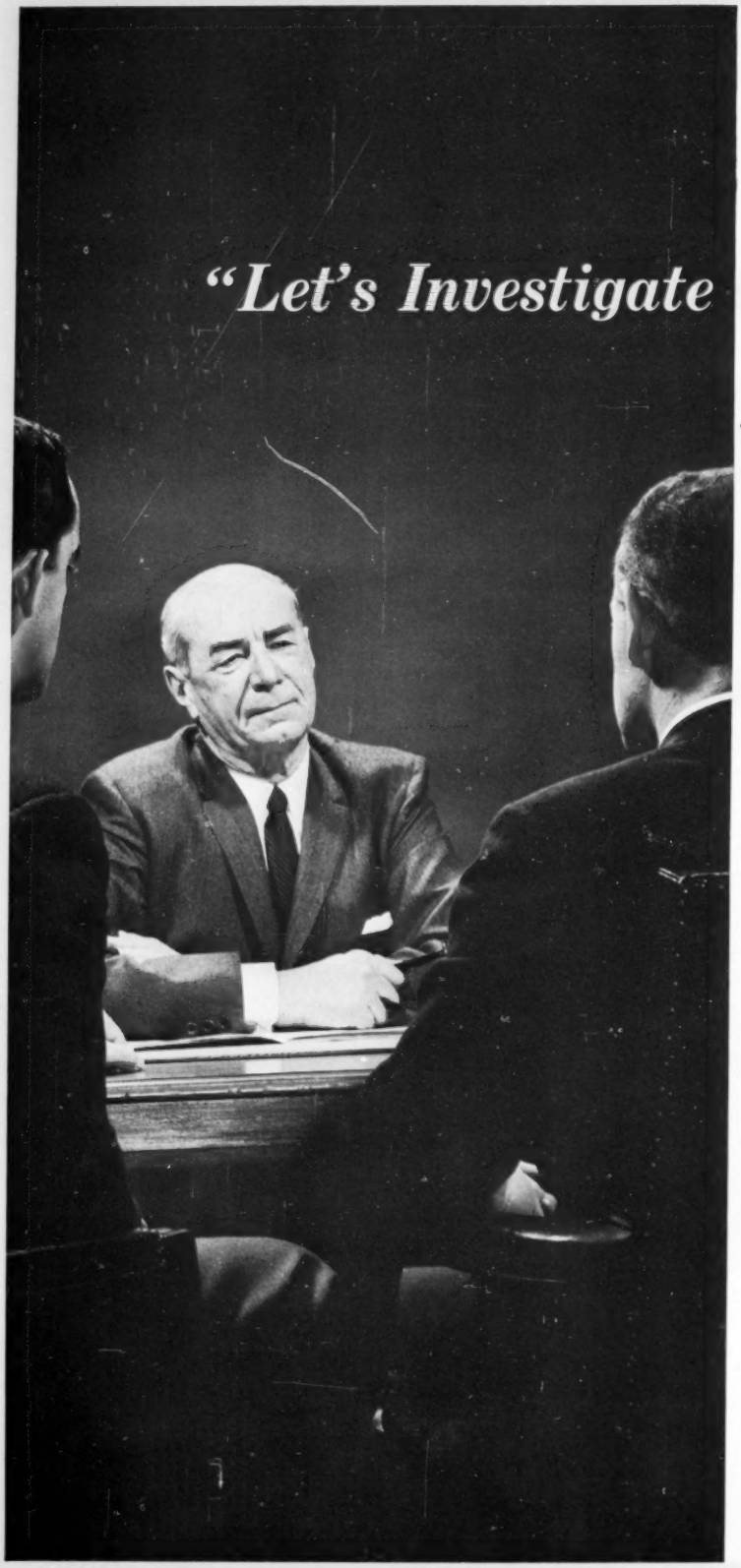
The plan currently being considered by the National Joint Computer Committee for moving the time for the Eastern Joint Computer Conference to late spring and the Western Joint Computer Conference to late fall is different from that reported in DATAMATION in February. If adopted, the plan would unfold as follows: 1961 EJCC, December, Washington; 1962 WJCC, May, San Francisco; 1962 EJCC, December, Philadelphia; interim JCC in 1963, May, possibly Minneapolis, Detroit or Chicago; 1963 WJCC, November, Los Angeles; 1964 EJCC, May, Boston; 1964 WJCC, November, San Francisco; 1965 EJCC, May, New York City.

SYLVANIA DEVELOPING SP SYSTEMS

Sylvania tells us that a DATAMATION statement in the February issue was in error. Special purpose computer systems (not the 9400) may be marketed commercially, we are told, and SCORE, a system including special purpose dp equipment, is under development for future use in supermarkets. "Several other special purpose systems are in the planning or development stages," a Sylvania representative wrote, "systems which are ultimately expected to find commercial application."

PB-250 LOGS 1100 CONTINUOUS HOURS

In the No-Other-Manufacturer-Can-Make-That Statement Dept., Packard-Bell Computer states that the first production model PB-250, delivered to the Bailey Meter Co. in Cleveland, had completed (on 2/27/61) 1100 hours of continuous operation without interruption or error. Eight other 250's have been delivered to date.



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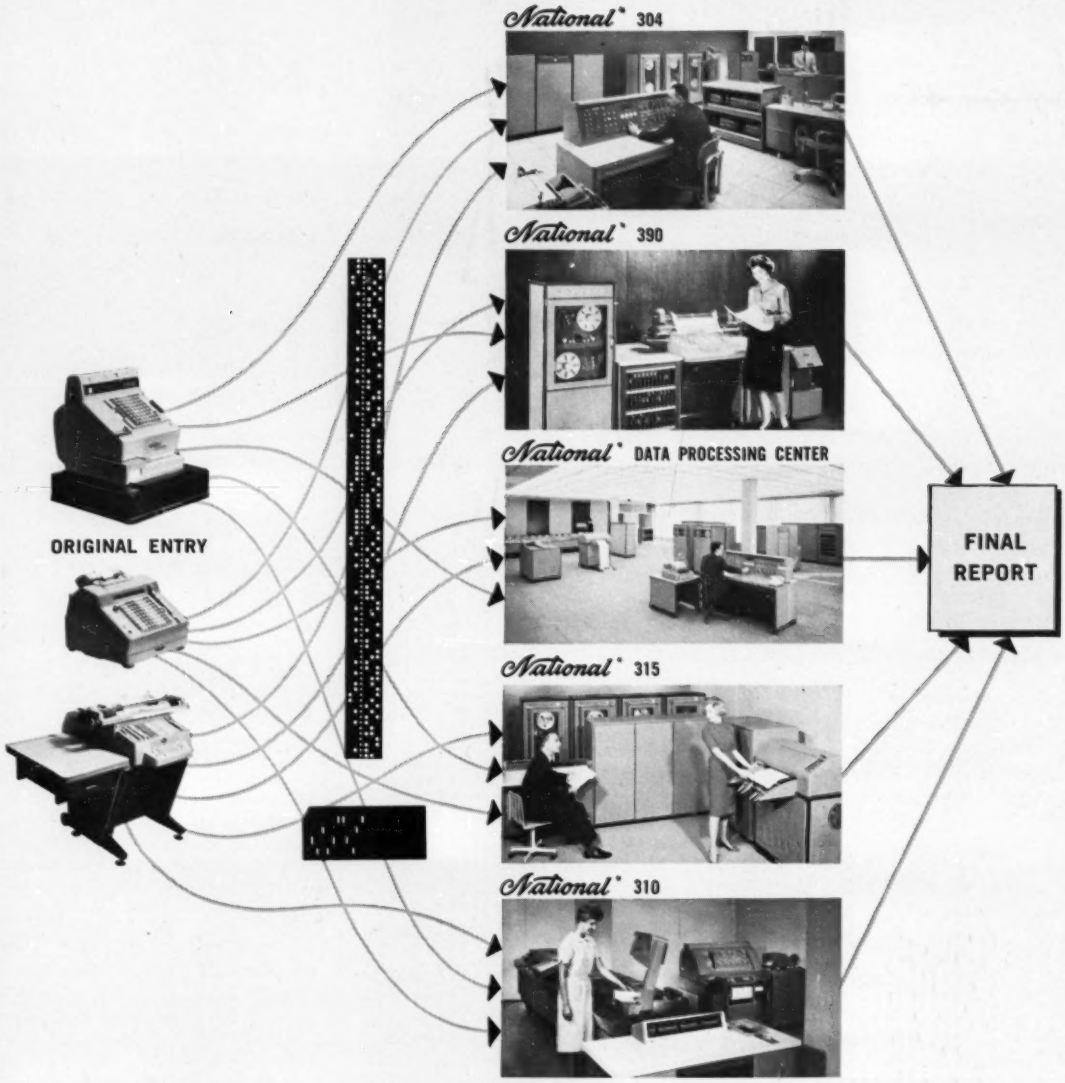

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CIRCLE 8 ON READER CARD

1961 IMPORTANT DATES

• National Telemetering Conference will be held May 22-24 in Chicago, Ill. (See page 84.)

• A Symposium on Large Memory Techniques for Computing Systems will be held on May 23-25 in the Department of Interior Auditorium on C St., between 18th and 19th Streets, N. W., Washington, D. C.

• TRANSAC Users Group No. 8 will be held in Hartford, Conn. in May.

• NMAA Annual Meeting will be held June 28-30. For information contact William F. Mauk, NMAA Administrative Headquarters, 170 W. Central Rd., Mt. Prospect, Ill.

• The G-15 Users Exchange Conference will be held August 10-12 at the Denver Hilton Hotel, Denver, Colorado.

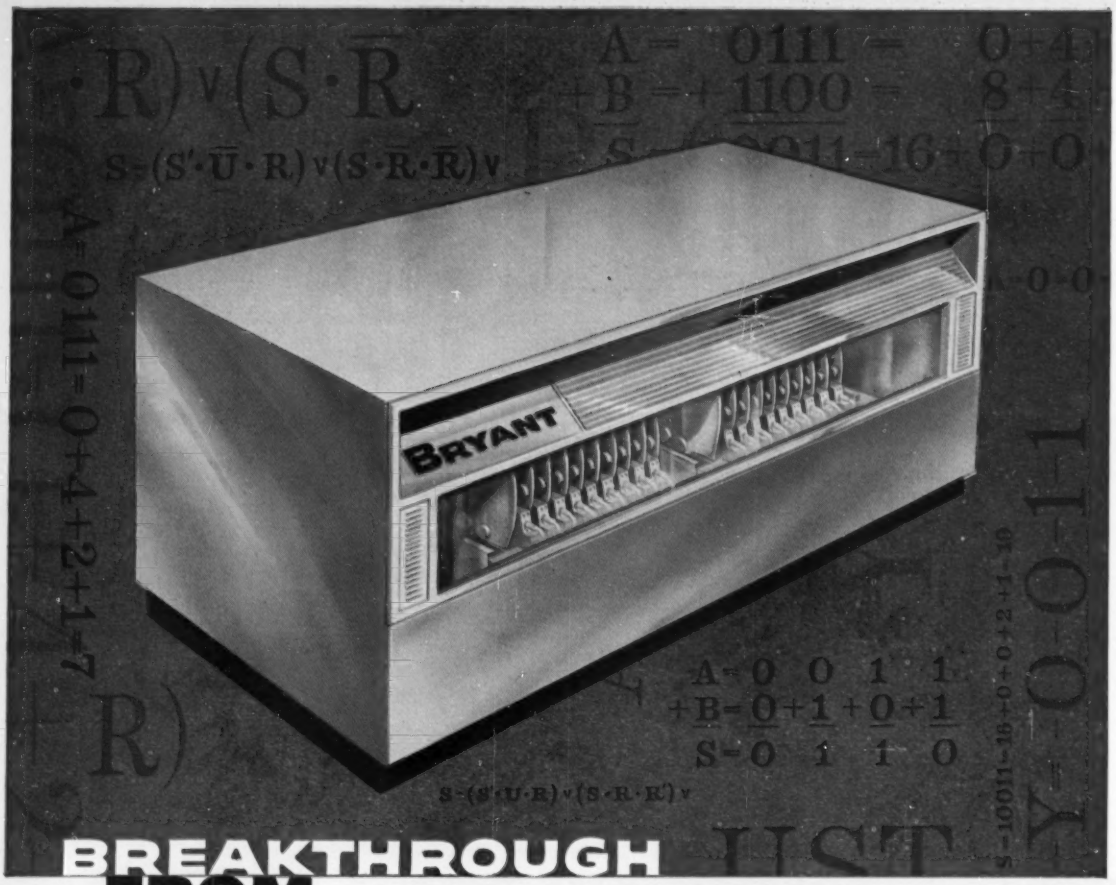
• WESCON is scheduled for the Cow Palace in San Francisco, Calif., August 22-25. For information contact WESCON Business Manager, 1435 La Cienega Blvd., Los Angeles, Calif.

• The National Symposium on Space Electronics and Telemetry will be held in Albuquerque, N.M., September 6-8. For information contact Dr. B. L. Basore, 2405 Parsifal, N. E., Albuquerque, N. M.

• International Symposium on the Transmission and Processing of Information will be held at the Mass. Institute of Technology, Cambridge, Mass. September 6-8. For information contact Peter Elias, RLE, MIT, Cambridge 39, Mass.

• The 1961 Annual Meeting of the Association for Computing Machinery will be held at the Statler Hotel, Los Angeles, on September 6-8. For information contact Benjamin Handy, Chairman Local Arrangements Committee, Litton Industries, Inc., 11728 W. Olympic Blvd., Los Angeles, Cailf.

• The Third International Congress on Cybernetics is scheduled for Namur, Belgium, September 11-15. For information contact Secretariat of The International Association for Cybernetics, 13 rue Basse Marcelle, Namur, Belgium.



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The new Bryant Series 4000 Disc Files incorporate all of the advanced engineering and design concepts responsible for the success of the already-delivered prototype . . . plus modular construction to provide tailor-made solutions to a wide range of mass memory requirements. Among the features are:

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CIRCLE 9 ON READER CARD

Programming

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The widespread acceptance of the PHILCO 2000 Data Processing System continues to open up new opportunities for experienced computer marketing personnel.

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DATAMATION 61
the automatic handling of information *april*

editor's readout

A NEW EDITOR FOR DATAMATION

It is a pleasure to announce that Harold Bergstein has been appointed Editor of DATAMATION, replacing Santo (Sandy) Lanzarotta who has been with DATAMATION since January 1958 and its Editor since January 1959.

Hal Bergstein, a journalism graduate of the University of California, brings more than ten years of editorial experience to his new assignment in the top editorial spot of DATAMATION. While operating as Managing Editor of DATAMATION, he has shown great ability to quickly assimilate the complex concepts associated with the relatively new field of computers, data processing and related equipment.

The new Editor takes over on May 1st and will continue the policy of offering complete and timely coverage of the information handling field.

Sandy Lanzarotta leaves DATAMATION to pursue a career in public relations. In accepting Sandy's decision with regret, we wish him much success in his new venture. He has made outstanding editorial contributions in the data processing field. — *Frank D. Thompson, Publisher*

QUESTIONS, ANSWERS & A FAREWELL

Some questions about computing have been answered in the three years this editor has been associated with DATAMATION and some continue to perplex the brothers and sisters of the information processing community.

The answered questions which come most readily to mind are these:

Will the industry become truly competitive? Will computing be widely accepted? Will other dramatic hardware breakthroughs quickly follow the introduction of solid state circuitry?

With some 21 companies now producing gp computers and more giving the picture a careful look, the answer is obviously affirmative. Moreover, those who predict an early shakeout among the competitors are dreaming. And this leads into the answer to the second question.

The experts are talking about 30,000 machines by 1965 and 75,000 by 1970. Computing has moved from the gimmick stage to an era of general acceptance. Nearly everyone in business, industry and science recognizes the value of these machines and as more and more firms turn out selective and economical equipment, full acceptance **and** use will soon follow.

Solid state circuits brought faster speeds; thin films and other new memory devices are with us, but those who know hardware say that no drastic changes are likely to take place in the next five years.

Some questions which have yet to be answered are these: Will attempts to establish common computer languages succeed? Will there soon be an effective national voice for the computing profession?

COBOL exists, but there are few who are really enthusiastic about it. As for its acceptance on a wide, interchangeable basis by all computer users, that may be possible in three to five years. What about ALGOL? We are told a motion to scrap that language was introduced (and tabeled) at the recent SHARE meeting in San Francisco. Its acceptance would seem to be something less than unanimous.

The American Federation ot Information Processing Societies has been formed and will soon be operational. Here lies the best hope for computing to date. If this group speaks and acts with authority as a national group, the curse of bad press and erratic public opinion may soon disappear.

I would like to thank all my friends in computing for their help, interest and encouragement. To Hal Bergstein and DATAMATION – the best of luck! — *Sandy Lanzarotta*

A new era for data processing application:

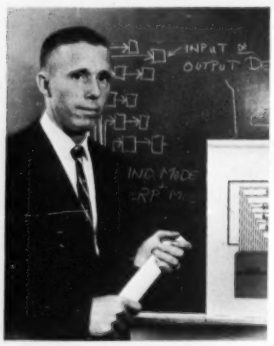
THE COMPUTER BA

IN THE FOREGROUND of a promising new era of data processing application, System Development Corporation, Santa Monica, California, has confirmed plans to broaden the scope of a major research program in computer-based automated teaching.

A new facility for the study of automation in educational systems, designated CLASS (Computer-Based Laboratory for Automated School Systems), will utilize the Philco 2000 as a central control unit and data processor. CLASS is a part of the large System Simulation Research Laboratory at SDC.

As a major development in the field of automated teaching, acceptance of the computer-based school system has been shown to be both economically feasible and a marked advance in the technique of implementing sound educational principles.

Since 1959, the Automated Teaching Project at SDC has been using a Bendix G-15D programmed as the control and basic decision-making element of a teaching machine. For research in automated instruction, the computer has been programmed to select and sequence instructional material for a student, store data on student progress, and provide immediate progress evaluations to the student. Unlike simpler electro-mechanical teaching devices, the computer-based machine can make complex decisions relating to sequencing of instruction, thereby adapting its pedagogy to best meet the needs of individual students.



Responsible for the CLASS development are members of a research project on automated teaching in the Research Directorate of SDC. The accompanying article was instigated by DON D. BUSHNELL, a member of the project and Research Directorate since February, 1960, and formerly with the Research and Analysis Staff in the System Training Division of RAND Corp. A paper and interview with Mr. Bushnell serve as the basis for the following feature.

G-15 operation

A single student working with the G-15D begins by reading several logically ordered items displayed on a small screen from a 600-slide random-access projector (RAP-600), developed for this purpose by SDC engineers. When the student is questioned on the information he has read, he inserts his response on the computer typewriter. After the response is recorded and evaluated by the Bendix, results are made known to the student via the typewriter.

Within a few seconds, the next step in a given topic is presented. Inherent flexibility of the G-15D enables the machine to "branch" to other areas of instruction when additional explanatory information is required, or to eliminate entire sequences of educational frames when the student is able to progress more rapidly.

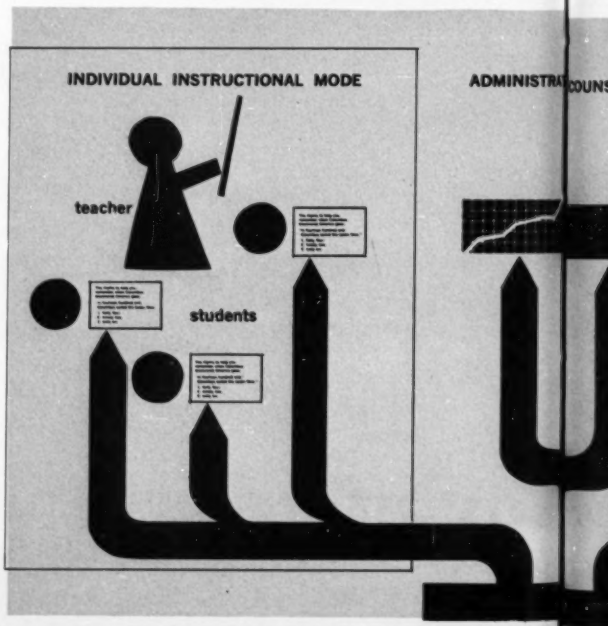
Prior to an experimental run, the G-15D is programmed for its teaching functions by reading through a perforated paper tape. The instructions on this tape represent decisions on type and sequence of educational "items" to be selected for each student on the basis of his overt learning behavior.

The G-15D sends four signals of four bits each to the Projector Adapter; three of these signals set the stepping switches which record the computer's instruction to the RAP 600. The first signal clears the relay register of any previous information. In addition to these signals, there is an interlocking feedback control which prevents changing of instructions while the system is in operation. This is represented along the feedback control line which is an inhibiting circuit and operates an inhibiting relay in the Projector Adapter.

While the RAP 600 control box reads the signals, the G-15D is prohibited from entering any further information. When the RAP 600 has carried out its instruction, it removes its inhibition from the relay which in turn, removes the inhibiting factor from the computer.

The other control lines are associated with the information contained on the cards which constitute the instructions. The CA-1 (an adapter connecting the card punch to the G-15D) is normally connected directly to the G-15D but in this system, the Projector Adapter replaces it, and the CA-1 in turn, is plugged into the Projector Adapter. However, if the control in the Projector Adapter is turned to manual, the CA-1 is connected directly to the G-15D.

In a manual mode of operation sometimes used by the experimenters, the manual data keys at the lower part of the Projector Adapter are directly connected to the



by HAROLD BERGSTEIN, Managing Editor, DATAMATION

ER BASED CLASSROOM

stepping switch and, by this means, can command the RAP 600. Operating in the computer mode, it takes the G-15D about 600 milliseconds to transmit to the RAP 600 the full command for a slide selection.

the 2000 facility

Use of the Philco 2000 in the new CLASS facility will enable the SDC staff to instruct in individual, group, or mixed modes where some students function independently while others work in small groups. It is conceivable that several hundred students could be simultaneously and individually tutored by a moderately large computer such as the 2000.

For individual instruction, a manually operated film reader serves as the output source. Students, working independently, can make multiple-choice responses on the I/O unit keyboard. The computer will be programmed to analyze these responses, signal the correct answer on the response keyboard and instruct the student where to proceed next by way of a four digit read-out panel on the I/O device.

For the group mode of instruction, the RAP 600, closed circuit TV, or the human teacher acts as the output source.

The teacher or experimenter will have four sources of information available with which to monitor student learning behavior, call up information on individual or group performance to help him teach, assign homework, or provide guidance. These are: (1) a teachers' display console, consisting of lights and switches corresponding to the different student I/O stations, which can present forced displays according to certain criteria programmed in the computer; (2) a soundproofed Flexowriter which will present the monitor with individual, subgroup, or group performance data; (3) a read-out panel, similar to an individual student's I/O unit, which will make it possible for the experimenter or instructor to monitor a specific student; and (4) a film for following the educational program.

Counselors will use an alphanumeric typewriter to call up student histories, and record diagnostic data.

For administrators, a 900 line-minute high-speed printer, operated either on- or off-line, will supply immediate information on the state of academic knowledge of each student. Less urgent reports necessary for scheduling and curriculum planning; for budgeting and logistics, can be retrieved when the computer is not selecting and analyzing instructional programs.

A real-time switch and storage equipment, which permits coupling human inputs and outputs to the computer, is under development at SDC. This machine will be able to sample and record in the computer some 4,000 input signals ten times a second. The machine also permits distribution of 4,000 output signals to the simulation area

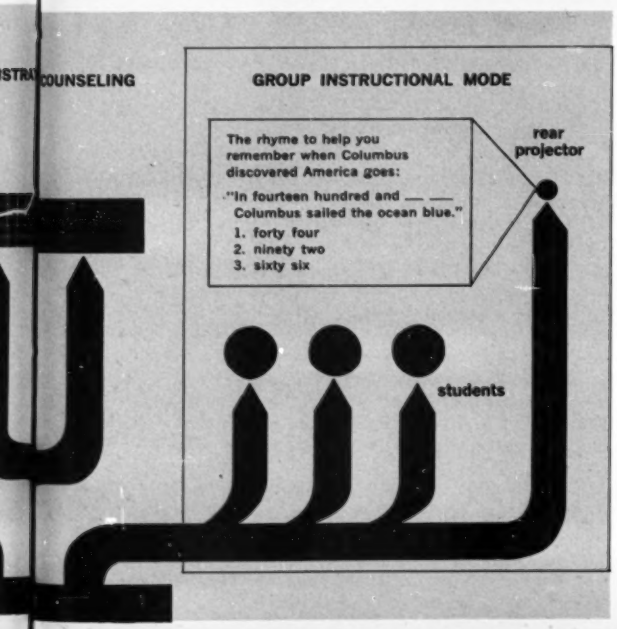
every 1/10 second. Capabilities for increasing the sampling and distribution rate will be provided. A plugboard for rearranging the receptor and effector connections to computer memory locations will also be included.

The Philco 2000 has a 10 microsecond memory access time, floating point capabilities and 8 index registers. The random access memory will originally consist of 16,384 48-bit words, expandable to twice this amount. Drum memory of 32,768 words is also provided. Peripheral equipment will consist of eight magnetic tape units, a high-speed printer, a card punch and a card reader. A buffer control unit provides on-line/off-line operation.

programming CLASS

Computer programs written for this project fall into two broad categories: the assembly of lessons and computer controlled instruction. The lesson assemblers resemble, in both structure and function, the typical computer compiler-assembler. The instruction control programs have many of the characteristics of the usual process control programs.

Lesson assembly programs for CLASS will be designed to generate a magnetic tape that contains a complete description of the teaching machine's program. The assembled tape, when read into the computer, will store


COUNSELING
GROUP INSTRUCTIONAL MODE
The rhyme to help you remember when Columbus discovered America goes:
"In fourteen hundred and — — Columbus sailed the ocean blue."
1. forty four
2. ninety two
3. sixty six
rear projector
students

in memory, codes of the instructional items; the codes of counters to be used for tallying the number of student errors per teaching concept, and teaching instructions.

The teaching control program will be designed to control the input/output functions, process teaching routines, and record the results of instruction.

The primary language to be used for the CLASS computer program will be JOVIAL, a general purpose programming language initiated at SDC. It is a readable and concise language, utilizing self-explanatory English words and the familiar notations of algebra and logic. It has been found especially suitable for problems requiring an optimum balance between data storage and program execution time.

In addition, JOVIAL is a machine independent programming language and can serve as a means of realizing a stated process on a number of different computers.

the cost factor

Considering the cost of computers, how feasible is a computer-based educational system? The answer would have to be "not very" if a large central computer were required for every school. But it is possible that in the future several schools would be served by a single centralized computer. For example, the California Department of Education, under the auspices of the NDEA, is currently conducting practical studies in the application of electronic data processing for pupil personnel services at the secondary level. Five schools in the Richmond (California) School District are successfully being serviced by a central computer facility.

Similarly, we may contemplate a powerful miniaturized computer of the future, processing data obtained from large numbers of students in several schools. It is conceivable that with a moderately large computer, several hundred students could be simultaneously and individually tutored. In the group mode of instruction, when the entire class is receiving the same instructional material, the only limitation on the number of students that can be tutored depends on the nature of the analysis of student performance that has been requested. A concomitant increase in productivity per man-hour of teaching effort would help to offset the cost of the computer.

Increased efficiency in the data processing tasks of administrators and counselors would also be a factor to consider. But perhaps the most important consideration is education in depth proposed by many advocates of new instructional technologies.

It is easy to speculate on the future automated university or secondary school system. Visualize a computer-based library connected to a national library system where students seated in front of consoles can call up information on the current state of knowledge in any area of the sciences or arts. Consider a student study area where students in their individual study cubicles, are instructing themselves with the aid of a machine tutor which is linked via the school-system computer to a national information-retrieval system that is processing written data into courses of study, developing diagnostic questions, and searching for answers to questions students ask. The same computer that serves the students can be accumulating data and performing analysis for the educator.

Within the realm of more immediate accomplishment, SDC's CLASS facility will be completed this summer and it is possible that within five years, the first computers will make their debut in the nation's classrooms.

PROGRAMMING A COMPUTER TO TEACH

by DON ENGLUND and DON ESTAVAN,
System Development Corporation

COMPUTER PROGRAMS for the SDC automated teaching system fall into two broad areas: assembly of lessons and computer controlled instruction.

lesson preparation

The lesson designer writes or selects a set of instructional materials covering the concepts within the subject matter to be taught, and prepares a flow of the lesson. The flow includes all of the items and logical decisions necessary for the lesson.

This information is manuscripted, punched on cards, and processed by a Lesson Assembler Program. This Program reduces item information and decision description statements to tabular form. Finally, lesson information is output on tape.

Figure 1 represents a sample history lesson. Items in this example were not designed as a good teaching set; they merely illustrate some types of decisions at the disposal of the lesson designer. When a student is having difficulty with a concept, decisions must be made regarding the appropriate series of remedial items to correct his errors. Sometimes the diagnosis can be made on the basis of a single response; other times a decision must be based on the number of errors over a series of items.

The first item in Figure 1 illustrates a decision made on a single response. If the student answers that Columbus discovered America, he will be told he is correct and will be branched to item 3. However, if he answers Ponce de Leon, he will be told "Columbus" is the correct answer before he is branched to item 3. If the response "Leif Ericson" is made, a special remedial item, item 2, is displayed explaining who Lief Ericson was and the student is required to answer the first question again before proceeding to item 3. Items 5, 6, and 12 also make decisions on a single response.

Decisions based on accumulated errors are made after items 3 and 9. Upon completion of item 9, if the student has made no errors, he will be branched to the end of the lesson. If he has made only one error, he is branched to item 12. If more than one error has been made, two remedial items are given before item 12.

Item 12 illustrates the use of self-evaluation. The student is given the choice of ending the lesson, reviewing certain concepts, or repeating the entire lesson.

The path a student will follow through the instructional

items is dependent upon the errors he makes. Only items 1, 3, 6, 8 and 9 will be seen by a student making no errors. Remedial items will be seen only by students having difficulties with the material.

Although this description is applicable to both the Bendix G-15 based system and the Philco 2000 based system, details of lesson preparation are necessarily different for the two systems.

the G-15 system

Flow information is manuscripted on two forms for the G-15 system. The first form, the Item Manuscript, lists all items and describes their characteristics (i.e., slide numbers, number of responses, correct answer, associated concept counters, and feedback messages and branch points associated with each alternative response).

The second form, the Command Manuscript, contains, in coded form, logical and arithmetic statements which constitute flow decisions. These statements or commands instruct the control program to perform such operations as typing messages, incrementing or decrementing counters, testing the contents of counters, branching on specified counter values, and setting maximum response times. The lesson designer does not write these statements in machine language but in a specially devised pseudo-language which is easy for a nonprogrammer to learn and use.

Both manuscripts are punched on cards and the command deck is merged with the item deck to form a lesson deck. The lesson deck is then read (via an IBM 026 connected to the G-15) and processed by a lesson assembler program which replaces all symbolic references with relative references, checks for some kinds of manuscripting errors, and transforms all lesson information into proper form for output on the Lesson Tape. The Lesson Tape (punched paper tape) is the primary input to the control program, MENTOR 15.

the CLASS facility

In this case there are three manuscripts: the item manuscript, command manuscript and flow manuscript. The item manuscript contains item information which is independent of the flow such as the correct answer, the number of alternatives, booklet page (or slide number) on which the item appears, maximum allowable response latency, and concept counters associated with the item. Decision statements are coded on the command manuscript using a modified subset of the JOVIAL Language, and ALGOL dialect developed at SDC. This English-like language is even easier to learn and to use than is the pseudo-language used for the G-15 system. The flow manuscript lists the items and commands as they are to occur in the lesson flow. On this manuscript the commands are not written in detail; only their symbolic names are used for reference to the command manuscript. The manuscript also contains item-related information such as feedback codes for each alternative response.

These manuscripts are punched on cards and processed by a lesson assembler program for output on magnetic tape. The lesson assembler serves to integrate the information from the three manuscripts. The flow and item descriptions are assembled and placed in tabular form and symbolic references are made relative. Decision statements are translated into relocatable computer instructions. The assembled lesson is then added to the Subject Matter Tape.

computer control of instruction

The function of the control program is to present instructional materials (items) to the student, evaluate the student's responses, and interpret the information obtained from the Lesson Tape.

MENTOR 15

It is not possible to store all item and command information for a complete lesson in the G-15 because of the ma-

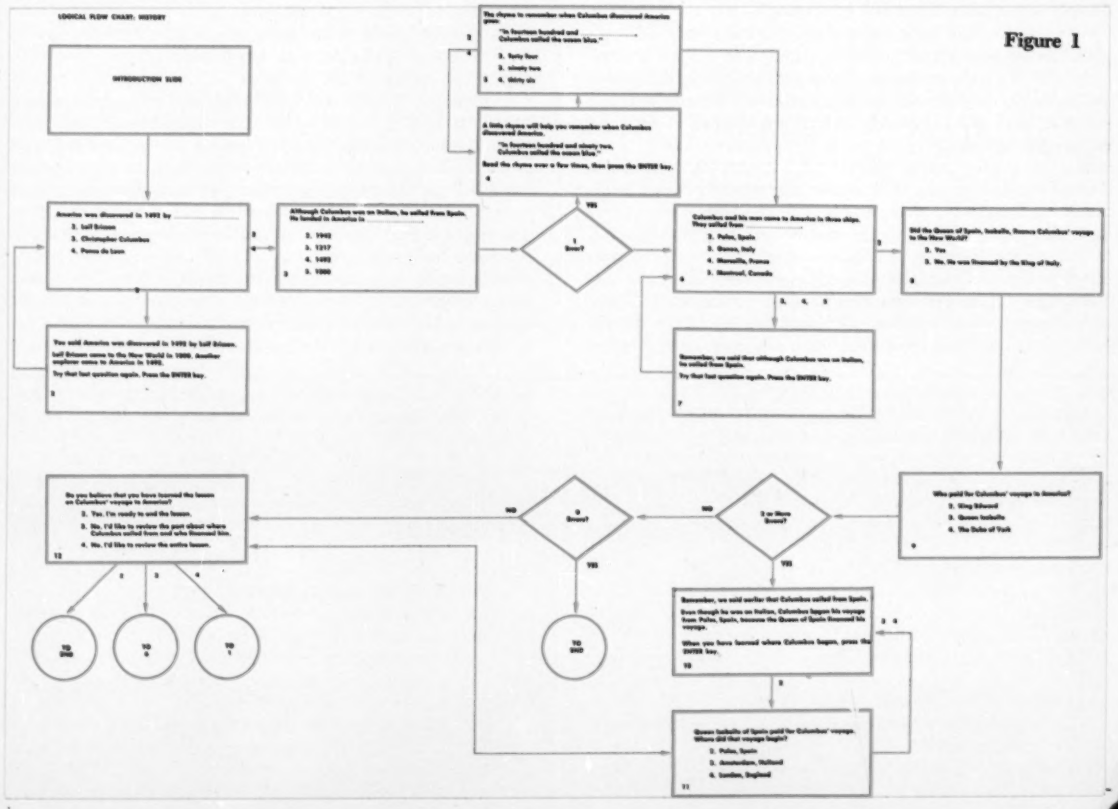


Figure 1

chine's limited memory. Consequently, the control program, MENTOR 15, reads blocks of records from the Lesson Tape into temporary storage as needed. The student responds to slides (items) via the typewriter keyboard.

After the student has made his response, he presses a special enter key signalling MENTOR 15 that he has answered. MENTOR 15 will accept as the response only the character typed immediately before the enter key, thus allowing the student to change his mind. The student's response is then evaluated by comparison with the correct answer as indicated on the Lesson Tape and the feedback message associated with the response given is typed out. If the student's answer is wrong, all concept counters tied to the item are reduced by one. Finally, MENTOR 15 will transfer to the item indicated as a transfer point for the response given. If no such transfer point is indicated, MENTOR 15 will proceed to the next item or command in sequence. However, the next slide will not be presented until the student signals that he is ready to go on. This allows the student to reread an item if he wishes after he has received feedback.

MENTOR 15 also keeps track of response latency by counting computer drum revolutions, and may make decisions based on time. For example, if a student is taking an inordinate amount of time to answer, the computer bell may be rung to let the student know that he is taking too long. Or, MENTOR 15 may take over control of the typewriter and type a message telling the student he has taken too much time, and proceed to the next item. MENTOR 15 may also count the number of times the student's response time has been excessive, and execute branching decisions on this count.

MENTOR 15 also keeps a variety of records, including the number and identity of items seen by the student and the number and identity of those items missed.

MENTOR 2000

The organization of the control program, MENTOR 2000, for the CLASS facility, will differ considerably from MENTOR 15 because of the greater power of the Philco 2000 and the difference in scope of the teaching systems.

Before the instruction session starts, the teacher inputs the student assignments from punched cards or on the typewriter. This information is used to bring into the computer memory from the Student History Tape the required records. A section of core memory is set aside for the maintenance of each student's progress and performance. Each lesson required during the training session will be read from the Subject Matter Tape.

Inputs from the students' and teachers' consoles will be supplied to the computer memory every 100 milliseconds on automatic interrupt. Outputs to these consoles will be read from the computer memory automatically every 100 milliseconds. Signals to and from each student and teacher will be transmitted in parallel. The control program will scan the input buffer and take actions for those students and teachers having pressed buttons during the past input cycle. As a student or teacher is serviced, his signals will be removed from the input buffer. If all stations are not serviced before the next input cycle, the new input signals will be "or'd" to the old and processing will continue. When outputs for a station are determined, they are placed in the appropriate bit position of the output buffer and transmitted on the next output cycle. The output buffer is erased on output.

When a student is serviced, his response is checked for correctness and the appropriate feedback message is placed in the output buffer. If the student's response is not correct, the error is tallied for each of the concepts with which this item is associated. On receiving the signal to proceed to the next item, the instructions are executed to select the appropriate item for the student.

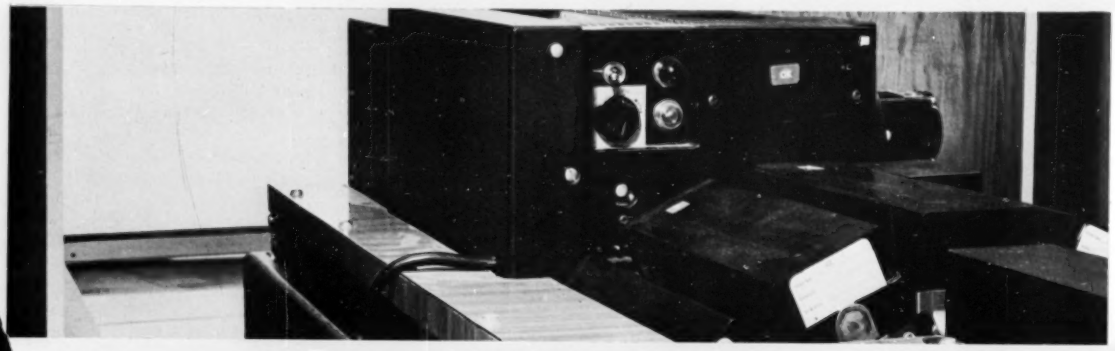
A complete description of each response (i.e., the item number, student number, response, and response latency) is recorded in the Lesson History Table. When the capacity of this table is exhausted, the table is output to magnetic tape for analysis and reduction at the end of the training session.

Inputs from the teachers' consoles initiate certain actions to be taken with respect to a student. For example, a teacher may wish to monitor a student's performance or request a print-out of certain information about a students' progress. The control program automatically informs the teacher about students who are experiencing severe difficulty by means of alarm lights on the teacher's console.

In addition to the teaching program, other educational functions will be programmed on the Philco 2000 computer. Counciling interviews, class scheduling and registration, grade reporting, and administrative data processing are some of the areas for which we are planning future experiments. As yet, no detailed formulations of the computer programs required to accomplish these objectives has been completed.

It is hoped through the results of these research studies that methods will be developed to automate most of the routine activities of educators to free them to do more of the creative work they were trained to perform.

For its research teaching machine SDC engineers developed a 600-slide random access projector (RAP 600). The RAP 600 slide projector presents information and the G-15D selects the slides and analyzes the student's answers. A Projector Adapter acts as a buffer between the G-15D output and the RAP 600.



Peripheral components to be used in the CLASS facility (left to right): teacher's console, film viewer, response device, and Flexowriter.

EQUIPMENT FOR AUTOMATED TEACHING

by MARC BENDICK, Engineering Dept.
System Development Corporation

AS THE BASIS for future simulation of computer-based instruction, System Development Corp. will utilize a Philco Transac S-2000. Peripheral equipment will consist of 8 magnetic tape units, a high-speed printer, card punch and card reader. A buffer control unit provides on-line/off-line operation.

For its first experimental teaching machine, SDC selected a Bendix G15-D, and developed a 600-slide random access projector (RAP 600) and a buffer box (G15-D) Projector Adapter. In addition, manual control of the RAP 600 was added to the Projector Adapter for situations in which it was desirable to override the automatic program of the G15-D.

the computer

The G15-D computer is capable of two modes of operation: a fast mode in which it accepts instruction from magnetic tape, and a slow mode in which it accepts instruction from punched tape or card decks. The slow mode chosen to operate the RAP 600 was the one normally used with the IBM 026 key punch. Operating in this mode, the computer goes to a slow-out card punch reader and transmits four characters of four groups each in series to the Projector Adapter. The characters are in hexadecimal form. The first character in this series instructs the Projector Adapter to erase previously stored slide addresses from the relays. The other three characters contain the desired slide address, which the Projector Adapter stores in its relay register. The sequence of operations is repeated as each new slide is requested.

At the start of an instructional period, perforated tape transmits programmed instructions to the memory of the G-15D. As slides are presented, the student answers questions on a typewriter connected to the G-15D. The G-15D compares the student's responses to its programmed instructions in order to determine the appropriate feedback messages and the subsequent sequence of slide presentation. It transmits slide addresses in hexadecimal form to the Projector Adapter. A light on the adapter indicates when a slide is in view.

The computer output to the CA-1 is used as the driving and control circuits required to operate the RAP 600. The on-off manual control switch on the Projector Adapter automatically connects the CA-1 to the G15-D during manual operation.

The Projector Adapter and Manual Control are housed in a single container, along with logic control of the projector itself.

In operation the Projector Adapter accepts a series of four hexadecimal characters and translates them into a parallel binary code signal of ten bits: four bits to determine the magazine address, and six bits to determine the slide address. In addition the Projector Adapter controls an inhibiting relay which prevents the G15-D from changing the signal until a complete address has been read and the instructions carried out.

The Projector Adapter can be switched from computer control to manual control. In the manual control mode its switch logic connects the punch reader directly with the computer and also connects the manual push button to the switch-operated stepping relays. These relays develop the binary code necessary to talk with the projector.

As the last binary bit is stored, the Projector Adapter signals the RAP 600 control that a new address is ready. The RAP 600 control reads and stores the new addresses, and proceeds to locate and project the new slide. During the time the RAP 600 is locating the new slide, the computer is inhibited from outputting more characters by an inhibiting relay in the Projector Adapter. The RAP 600 control releases the inhibiting relay when the new slide is in position, and the G15-D then examines the next format to be projected.

random access projector

The display of information in the system is accomplished by the RAP 600. This device is a 35 mm slide projector with auxiliary equipment attached which gives it the capability of calling up any of 600 slides upon command. A wheel-like container holds 15 magazines in its periphery, one magazine in each of the magazine containers. These magazines contain 40 slides each.

The operation of the RAP 600 is controlled by a logic box mounted with the electronics in the Projector Adapter. This box performs the following functions: it receives commands from the Projector Adapter requesting a particular slide; memorizes the command; compares present position to the command position; commands the machine to move to the new position by the shortest possible route, and orders the slide exhibited.

Electronically the logic control circuits operate on the differential between the present address and a new address. This is done through the use of what is called com-

parison circuitry. Any movements of signals and/or components are considered as a function of an "unequal to" condition. As will be seen later, certain actions also take place when an "equal to" condition exists.

To select a slide at random, a magazine address and a slide address (which is a "block" of information) must be inserted into the logic control box. This input information is inserted manually or by the G15-D through the Projector Adapter. The magazine address is stored in a comparison circuit consisting of a set of relays which are located in the control logic and in the micro-switches of the cam logic boxes. Two things happen:

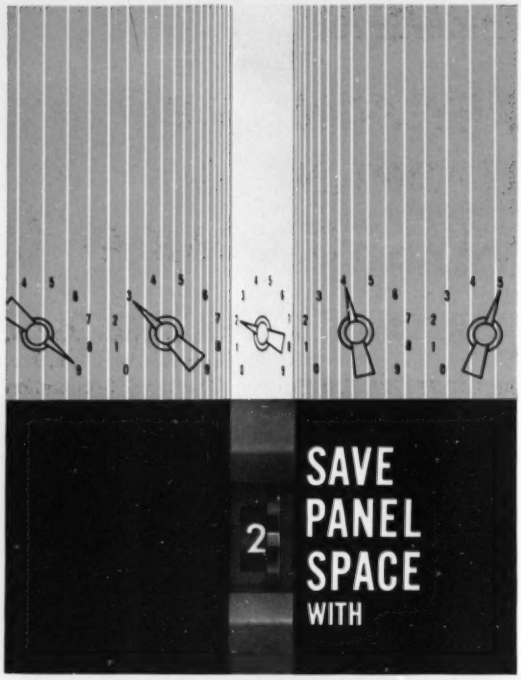
1. This comparison circuit simultaneously determines the rotation direction of the magazine storage drum which will be the shortest route to the address being sought, and
2. The circuit also activates the magazine storage drum motor relay, releasing the fine indexing solenoid (3) and starting the motor.

Upon reaching an "equal to" state, the magazine storage drum motor "stop" relay does three things: it removes current from the motor; sends current to the indexing solenoid; and activates the magazine insertion mechanism.

The logic to determine the direction of shortest movement for slide search may be obtained by subtracting the present position index number from the desired address index number. If the answer is positive, go forward; if negative, go back; if zero, stop. The index points of the slide holder slots are numbered from one to 40. The magazine is moved forward to index a higher numbered slide, and backward to index a lower numbered slide.

A binary code is used. This code requires six bits for each slide that is requested. Therefore, the system requires the comparison of six relays against six cams. It also uses a seventh cam as a clock pulse and seventh relay as a pulse latching relay to remember the data between clock pulses. The use of the clock pulse avoids address ambiguity as the cam followers are switching a changing status. A separate relay is also used for the motor circuit.

The logic for the shortest search for a magazine in the circular magazine storage presents a more difficult problem. The drum index is divided into halves, and both halves are assigned the same series of binary numbers. Positions on each half are numbered sequentially from lowest to highest. The positions on one half are assigned an additional identification bit. The logic control then states that when the result of the subtraction of present position from desired position is negative, the shortest route is clockwise; and when the result of the subtraction position is positive, the shortest route is counter clockwise. This applies only if both positions are on the same half of the drum. If they are on opposite halves of the drum the reverse is true, and in this case the extra bit reverses the logic by operating an additional relay - which reverses the forward and back lines. If, however, the desired magazine is on the other half and at the exact opposite position it is readily apparent that either direction is an equal distance.



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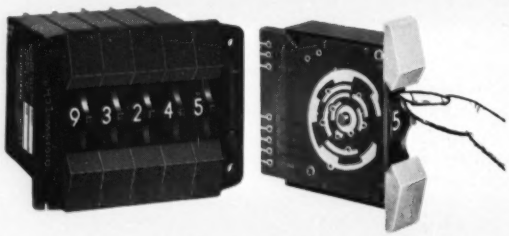

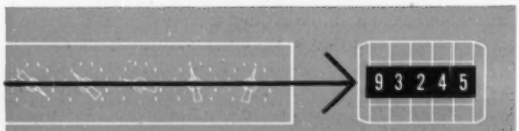

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CIRCLE 10 ON READER CARD

Guest Editorial

IRRESPONSIBLE REPORTING & HOW TO COMBAT IT

by DANIEL D. McCRACKEN,
McCracken Associates, Inc.
and FRED GRUENBERGER, The Rand Corporation

THE STRUGGLE for accurate reporting of the computer industry suffered one of its worst setbacks March 3. That was when LIFE published "The Machines Are Taking Over," by Warren R. Young, an associate editor of the magazine. The article probably contains more errors and distortions than anything yet published on the subject.

Item: "Whereas five years ago there were indeed only a few dozen computer installations, mostly clumsy million-dollar affairs used by atomic physicists and mathematicians to solve scientific problems, there are now 11,000 in action." The only way to get a count of 11,000 is to include everything larger than a slide rule in the definition of a computer; the only way to cut the figure for five years ago down to a few dozen is to exclude everything but the very largest.

Item: "Designs differ, but every digital computer contains millions of tiny devices which can be turned off and on to represent numbers." All 11,000 of them? By my calculations, a 2000-word 650 does not have this much storage by a factor of at least 20.

Item: "With only zero and one to contend with, the machine can be fed any desired number by means of a punch card on which holes represent ones and absence of holes represents zeroes." This of course is true for some machines, but the clear implication is that **every** computer can **only** deal with such cards, and Mr. Young says not a word about decimal and alphabetic input.

It must be admitted that the computing world does not suffer greatly by public misinformation about the number of bits on a 650 drum. If Mr. Young could only be accused of sloppy research, we would merely sigh sadly and forget about it.

This is *not* all, however. By a variety of techniques, the article leaves the reader with a badly distorted picture of both the uses and users of computers. The first technique is the use of unrepresentative examples.

Among other applications, Mr. Young mentions the grading of football players, the selection of marriage partners, the design of new games for a Las Vegas gambling house, the writing of TV Westerns, and the composing of Beatnik poetry. Along with such odd-ball uses, we hear of a number of others that although legitimate are in no way typical: the design of sausage recipes, the selection of ladies' handbag styles, crop selection for one-mule farmers, beating the commodity market, and playing tic-tac-toe. The standard applications are mentioned, but not one of them is given as much space as sausages or Beatnik poetry.

Another way the article distorts is through the following debatable quotation. "'In a complex case,' says Business Consultant Joseph Reres, 'the executive who still uses the traditional method of arriving at a decision, using his experience and judgment instead of computers, is doing so at Las Vegas odds'." It was not mentioned that hundreds of responsible computer people would repudiate such a statement out of hand. (In fairness, it must be noted that not all of the quotations are in this category.)

Finally, Mr. Young states as unquestioned facts a variety of things that are little more than products of his own fantasy. The American economy is putting itself at the mercy of electronic robots. Middle management will tend to become obsolete. A man close to the pulse of a computer can know more about the company than the president does. Computers were introduced into design work in a single giant step: the best previous assistance was provided by logarithm tables. "Once in a while, however, a programmer will be unduly carried away by his fascination and begin to identify with the machine. He is then given a therapeutic leave of absence until English has become his brain's native language again."

What can we do about such nonsense? We should register our disapproval in letters to the editor, but it must be realized that a few hundred letters from furious programmers isn't going to have much effect on TIME-LIFE. Cancel our subscriptions? Not a bad idea, perhaps, but that isn't going to amount to much either.

There is an answer, though, which we present as a five-point program.

1. Disabuse yourself forever of the idea that publicity – *any* publicity – is always good for you and your company. How would you like to be identified as a programming expert in an article that speaks of therapeutic leaves of absence for programmers?

2. Do not permit yourself to be quoted on any subject that can be distorted by careless writing, without a guarantee that you will have the right to review the article before publication. This will reduce the number of times you get quoted, but see Point 1.

3. Have no contact with reporters from magazines that have consistently demonstrated their irresponsibility, primarily a few of the mass-circulation consumer magazines. And I mean this literally. If you are approached for an interview, don't talk. Don't allow pictures to be taken. Don't even supply background information.

This sounds harsh, and it is. The fundamental fact is that no publicity is far better than grossly distorted publicity.

4. Take positive action to present the public with a fair picture of the computer industry by writing accurate articles yourself. You obviously can't publish in staff-written magazines, and special writing standards make it pretty tough at the major magazine level. This doesn't keep you from trying, though, and it doesn't keep you from writing for the smaller ones.

5. Be sure that you do not distort the public's conception of computers by such coy tricks as having one play Tic-Tac-Toe on the typewriter or Jingle Bells on a loudspeaker. No amount of talking can repair the damage that a poor demonstration causes.

Giving the public an undistorted idea of what we do is not easy, but the attempt must be made. If we give up in the face of the difficulty and the effort involved, the job will be left to Warren R. Young and those like him.

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CIRCLE 11 ON READER CARD

A "shortcut" to memory . . .

IBM's New Magnetic Cores

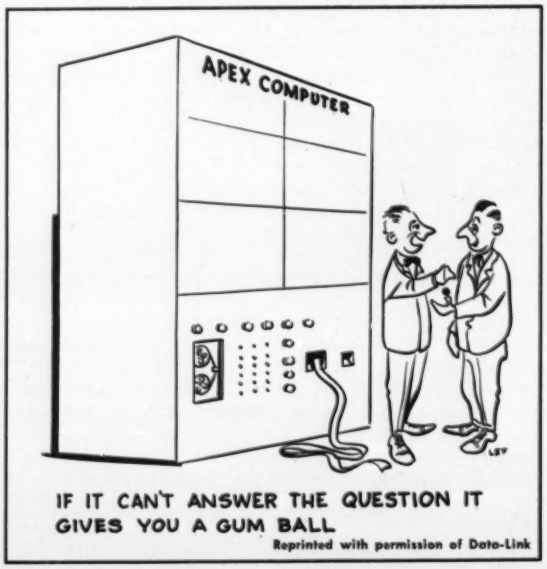
A NEW KIND of magnetic core memory for computers which contains built-in "shortcuts" to stored information was reported recently by the International Business Machines Corporation.

An experimental memory represents a significant advance in an approach to a relatively new concept called "associative memory." The prototype unit was constructed with existing components to show the feasibility of a ferrite magnetic core associative memory that can operate at speeds equivalent to today's memories.

"Shortcuts" provided in such a memory may, in the future, speed up access to stored information by eliminating the need for a considerable amount of programming. While the experimental unit has a capacity of only four information "bits," IBM has carried out extensive studies indicating that a large-scale associative memory, comparable in speed and capacity to conventional units now available, is technically feasible.

In a conventional memory, data is stored in "registers" at specific "addresses." To pluck the word out of the memory, the program being fed into the computer must specify the correct address. The experimental unit IBM reports is a "fully associative memory." This means that it is organized so that a word can be stored in any register and no address need be given to locate it. Furthermore, any fragment of a stored word may be used as an interrogation of all the memory registers simultaneously.

IBM engineers state that the experimental associative memory can also be operated as an ordinary addressable memory upon command and without any sacrifice in capability. They emphasize that the IBM associative memory approach aims at improvements in computer system speed and flexbility through advanced design rather than through new types of components alone. Although this experimental unit is a magnetic one, the associative concept is not limited to magnetic units but may be used in other memories as well. Previous technical papers by IBM research engineers have indicated that associative memory concepts may be used in cryogenic memories.



IF IT CAN'T ANSWER THE QUESTION IT GIVES YOU A GUM BALL

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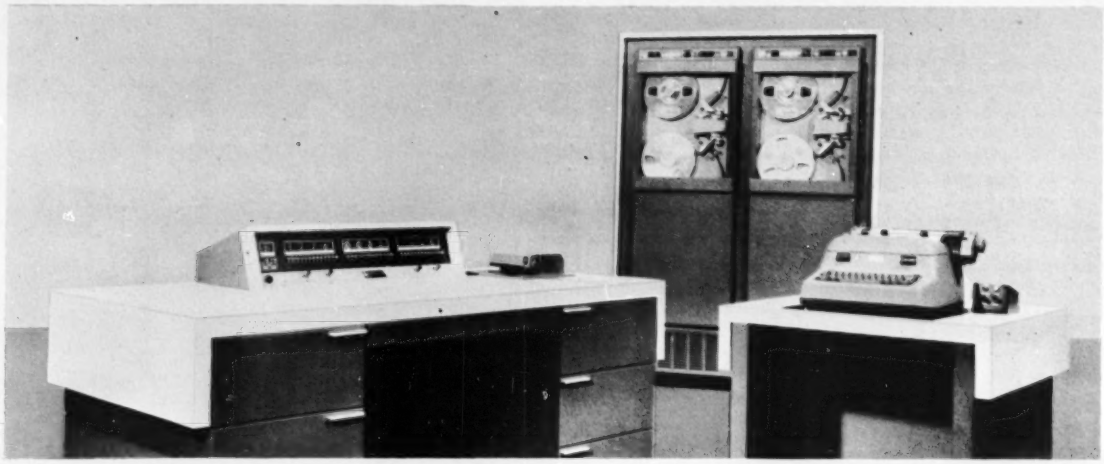
FROM CONTROL DATA



THE 160 ADDS AN A

CONTROL DATA CORPORATION'S 160-A, with a basic memory of 8,192 words of core storage, is the newest addition to that company's line of solid-state computers. These include the large-scale 1604 and the desk size 160.

The 160-A actually combines some of the outstanding features of both . . . to provide users with capabilities for data processing, scientific and engineering problem solving, on-line/real-time data acquisition and data reduction, and off-line data conversion. The 160-A can also be used in Control Data's Satellite Computer System. In addition, 160-A programming systems for a wide range of computer users include compilers and assemblers, interpretive systems, general scientific and commercial programs, and systems and service programs.

From the large-scale 1604, Control Data has designed into the 160-A such large-scale features as *buffered input/output*, interrupt, special powerful instructions, and additional, optional magnetic core memory modules up to a maximum of 24,576 words for a total of 32,768 words. Control Data has also designed into the 160-A basic 1604 circuits.

From the 160, Control Data has constructed the 160-A the size of an office desk in which to include the high density packaging of the core memory and the solid-state circuits. The 160-A uses only slightly more power than the 160, so that it can be operated under normal room temperatures.

160-A programming systems

With the new 160-A Computer, Control Data is providing an extensive package of programming aids. Under compilers and assemblers, Control Data will offer OSAP, which provides the programmer with a machine-oriented language for those logical and data processing problems not readily adapted to FORTRAN; and FLAP, which is a two-pass symbolic assembly program. A FORTRAN compiler, designed for both a minimum and maximum equipment configuration, is currently under development.

The *Interpretive Systems* for the 160-A include *INTERFOR*, which will provide more powerful arithmetic and logical functions through simulation of many commands taken from the large-scale 1604 Computer; CALINT which provides a simple, basic user-oriented language for smaller business and scientific applications; and BCK with which arithmetic manipulations are performed on three, six or nine decimal digits as specified by the programmer.

A large number of *Systems and Service Routines* are being provided for the 160-A computer. These will facilitate the following operations: off-line data processing, satellite operations in which the 160-A is used as a satellite computer to the large-scale 1604, visual display device programs, service routines, and magnetic tape handling programs.

Finally, a large number of general scientific and commercial programs are being provided for the 160-A. These include mathematical subroutines, generalized sort-merge routines, matrix algebra package, integration and interpolation programs, polynomial equation solvers, set of statistical routines, and conversion programs.

160-A buffered input/output

The input/output buffer register provides temporary word storage between the core memory and selected external devices. In addition, the buffer control contains an entrance register and an exit register which are preset by the program.

The entrance register contains the address of the memory location for the input or output word being transferred at any time during a buffered input/output operation. This register is advanced by one each time a word is transferred.

The exit register contains the input or output terminating address plus one. The contents of this register are constantly compared with those of the entrance register. When comparison of the contents in each register detects

CONTROL DATA'S 160-A

identity, the buffered input/output operation stops.

Since these three registers operate independently from the other registers, the 160-A is free to run its main program while the buffer is waiting for the slower external devices. With the buffer in operation at the end of each memory reference cycle, the input/output control circuitry determines whether or not a word is ready to be buffered. If it is ready, the program is momentarily halted while the input or output word is processed . . . after which the program is free to resume.

160-A's special instructions

Included in the 160-A repertoire of 91 instructions are special instructions. For example, with the STORE CONTENTS of P (Program Address Register), the programmer has the option of storing the address of the instruction which is currently being executed. The RETURN JUMP instruction means that only one instruction is required to store the return address in the subroutine. With the HALF-RIGHT instruction, the programmer can enter a character in a storage location without affecting the other character in the word. KEY CONTROL STOPS and JUMPS provide optional operator-initiated sequence controls.

160-A magnetic core memory

The 160-A basic memory consists of 8192 words of magnetic core storage. Additional memory modules of 8192 words each can be added up to a maximum of 24,576 words . . . for a total memory capacity of 32,768 words. The internally stored program switches from one memory module of 8192 words to another, depending upon the addressing mode.

160-A interrupt feature

The 160-A periodically senses the input/output channels for the presence of an interrupt. When an interrupt is detected, the program will jump to an interrupt sequence in memory, which includes the instructions necessary to return to the main program at the proper time. An interrupt is not recognized during a non-buffered input/output operation.

160-A input/output equipment

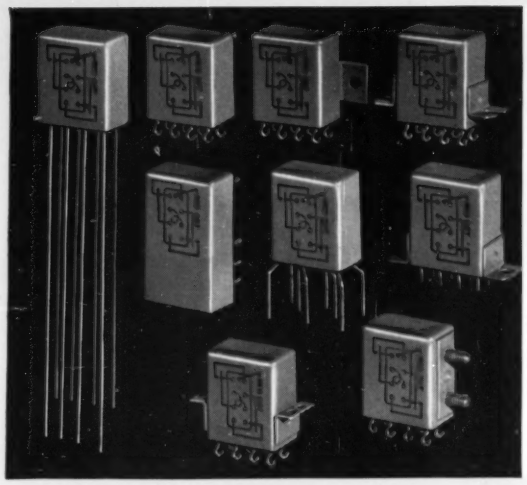
A variety of peripheral devices can be used with the 160-A. This equipment is also compatible with the 160 Computer. Provided as standard equipment on the 160-A are the high-speed teletype paper tape punch that operates at 110 characters per second and the Model 350 Paper Tape Reader, manufactured by Cedar Engineering Division of Control Data Corporation. The 350 Reader operates at 350 characters per second.

Optional input/output devices available for use with the 160-A include the following: magnetic tape systems (with either 15KC or 30KC character rates), 1000 lpm high-speed printer, electric typewriter, and a 1610 Control Unit for card reader, card punch, and 150 lpm line printer.

CIRCLE 100 ON READER CARD

NEXT MONTH IN DATAMATION

A look at Ferranti's ATLAS computer, England's version of STRETCH, and an interview with Erwin Tomash of Ampex (formerly of Telemeter Magnetics, Inc.) will be two items of interest in the May issue of DATAMATION. A detailed analysis of the Burroughs B-5000 and another sparkling offering by DATAMATION irregular Robert Patrick are also on tap. Watch for these features and many more.



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CIRCLE 12 ON READER CARD

Purdue's LGP-30 initiates a new role for

COMPUTING IN ENGINEERING EDUCATION

AIM: NOT TO FEAR the computer but to use it like a side rule. That's the goal for the students of Purdue University's School of Electrical Engineering, according to school head Dr. Thomas F. Jones, Jr., formerly of Massachusetts Institute of Technology.

The West Lafayette (Ind.) electrical engineers recently acquired, through the efforts of Jones, an LGP-30. Purdue is one of the first of the U.S. Universities and colleges to boast a digital computer for use at the undergraduate level.

Jones joins other educators who, realizing that engineering is in a state of great change, feel strongly that "All computers should be more available in educational institutions.

"The engineer," declares Jones, "who learns on one type of computer can apply basic techniques to another type of computer. But to do so we must rid ourselves of the notion that the electronic 'brain' is too complex for undergraduates to manipulate and get desired results."

Once a program tape has been prepared to solve a certain type of problem, the engineer is required only tc formulate his problem, insert the basic data. Results are typed out according to the format specified within a few minutes.

In the design of computers, engineers feed the computer a preliminary design, and the computer completely evaluates consequences of component variations (by allowing all to vary randomly) and advises the engineer of the practicality of the design and/or leads him to the best choices of the parts.

Jones stresses that examination of the figures shows that the number of general purpose digital computers has doubled every two years since 1945 and shows promise of continuing to double at two-year intervals for some time into the future.

Indications are that there will be some 50,000 digital computers in the U.S. by 1970 and this corresponds to an average of 1,000 in every state of the union.

Jones declares his point is this: "We can no longer neglect the existence of these devices in our formulation of a basic engineering education. I hasten to add that I do not propose that we concentrate on teaching the devices themselves. As a matter of fact, I feel that herein lies one of our problems in electrical engineering. These devices have been born and bred in electrical engineering and, as is often true with our offspring, we have been so concerned with the development of character that we have overlooked and/or misunderstood broad values and abilities.

"We have concerned ourselves with the design, construction, and programming of machines. We have given little real thought to the fact which now becomes apparent: these machines will change greatly the way in which our profession is practiced.

"I don't propose that we revolutionize instantaneously our teaching to take proper account of computers. Although the events of the last five years demonstrate that we have the courage, I doubt that we have, as yet, the knowledge and experience. Our knowledge of the role of computers in electrical engineering will evolve out of continuous efforts of teachers and other engineering practitioners.

"It follows, from the rapidly increasing availability and the obvious values of computers that these devices must emerge from elective status and become an integral part of the undergraduate process.

"A significant part of the instruction falls logically into the laboratories both because of the limited availability of the hardware and the natural ways in which the use of a machine can be integrated into experimental progress.

"The electronics, circuit theory, and feedback theory associated with digital computers probably should be taught in elementary and advanced circuits, and electronics, and systems courses, as normal illustrative classroom topics or as home problems. I propose that computers be introduced in the sophomore year as "black boxes" which can provide basic operations. As justification let us be reminded that a sophomore rarely understands the details of an oscilloscope, an indicating meter, a vacuum-tube voltmeter, a square wave generator or, for that matter, a power line. But he uses all of them.

"As a first experiment let him use the computer to solve for the transient and steady state behavior of an R-C, L-C, or R-L-C circuit, and compare this with analysis and with measurements on actual circuits.

"We shouldn't expect to get very far on the "first date" with computers. We should be happy just to introduce the student to new opportunities – for thought and learning.

"In subsequent encounters he can solve systems too complex for mathematical analysis within normal time limitations. But laboratory measurements can be made to develop faith in computed results.

"As all of us have observed, the study of machinery is

Dr. Thomas F. Jones, Jr., head of Purdue University's School of Electrical Engineering (left) and Robert E. Machol, professor of electrical engineering, concentrate their attention on an LPG-30 acquired by Indiana university.

rapidly being replaced by "energy conversion" which means something different to each and every one of us. In almost every case it relates to the dynamics of machines as related to systems performance, etc. (Note that the old machinery courses dealt with statics or machines in the steady state). If the computer is already a familiar tool (it should be to seniors), much aid can be given to the understanding of dynamics.

"Incidentally it's a good idea to have the computers available to students throughout the school week. New devices of this type provide a high level of motivation.

Dr. Jones continues. "Some of the preceding was based on experience. Most of what follows is based on future plans and conjecture as to how we might use the LGP-30.

"Should we teach digital computers to undergraduates? The data I quoted earlier convinces me. *We should.* We will study much the same sort of problems with the LGP-30 that we study on the analog computer, but the LGP-30 gives us added flexibility and special abilities as regards machine made decisions, etc. Now lets consider some *how* questions.

Q. Should we teach programming?

A. As I see it at this moment we should minimize this part of our instruction. We can teach a little at a time to meet our needs, along with some elements of numerical analysis. It is obvious that programming methods will change greatly over the next ten years. For the early stages of instruction I propose this: Put a routine into the machine for handling the specific type of problem to be considered. For example, a general program is available for inverting any matrix of size 45 x 45 or less. Once the routine is inserted the computer becomes, to all intents and purposes, a special purpose computer for solving linear algebraic systems having up to 45 variables. The student is required only to address a section of the machine storage and insert his set of coefficients and press the start button. A 4 x 4 or 5 x 5 determinant which the student has reduced previously by hand is recommended as a start so that he will have proper respect for the machine.

"Other routines will do such things as invert matrices of complex numbers, construct mathematical tables, and solve the time behavior of linear systems of various complexities. Routines can be, and will be, generalized so that no more need be done than select a routine for the correct number of independent variables. Incidentally, this concept gives support to Dr. Ernest Guillemin's efforts to incorporate net work topology into net work theory, for with a computer even a mediocre engineer can expect to solve systems for which the determination of the number of independent variables is not trivial. His principal job may be to: 1) determine the number of independent variables, 2) formulate a suitable set of equations, 3) select an appropriate computer routine from the library of routines, and 4) interpret the results. More on this later.

Q. How much numerical analysis?

A. Presently I feel that he should learn two-point and three-point differentiation and integration, be given an appreciation of error build up from round off, and know about at least one way of reducing a determinant. I feel that, for the student of average ability, the focus should not be on numerical analysis unless *he* so chooses. He simply needs to know enough to appreciate that the computer *does* have limitations.

Q. How much about computer circuits, logical design, etc.?

A. Just enough to disolve the concept of the computer miracle. He must learn that the computer functions in exactly the same way as a well-instructed and dependable but unimaginative person with an adding machine. No need beyond this for most students. I am sure that many educational administrators will shudder and ask whether they can afford a digital computer for undergraduate instruction. I say we must.

"This is more important than replacing old-model oscilloscopes with new models or replacing 1903 machines with 1960 machines.

Q. If computers will simply be another tool, why don't we just teach a course in computers and be done with it?

A. This viewpoint is not valid in my opinion. Computers will become more a way of engineering life in the future than the slide rule has been in the past. The slide rule was a shorthand – a substitute for hand computation. The computer will profoundly affect the way in which engineering is done. Techniques not yet considered will become practical with the computer as a tool.

"These things have already come to pass to some extent. Let me give you a very limited example. In the design of logical circuits, such as are used in data processing equipment (such as digital computers), the permissible tolerances on components are of the utmost importance. In the crude beginnings these values were determined rather incompletely by endless experimentation and a multitude of two-dimensional plots called "schmoo" diagrams – the region inside a distorted contour was the "allowed" region.

"Today routine techniques utilize a computer to evaluate a design. The machine is given a relatively complex mathematical model of the circuit, all parameters are varied randomly within reasonable limits and the extremes of performance and/or failure are determined. Thousands of circuit variations are evaluated each minute by a large computer. Within minutes all information needed for an optimum design is at hand.

"In many electronic data processing fields, computers are being used to prove hypotheses instead of building extensive hardware, Example: speech analysis.

"Similar revolutions are due to come in automatic control. We have developed a fabulous set of constructs in the frequency domain for analyzing and synthesizing systems. But our important specifications on these systems are in the time domain. Given a computer which solves time domain problems far more effortlessly than we handle frequency-domain problems, what new constructs will come forth? Time will tell.

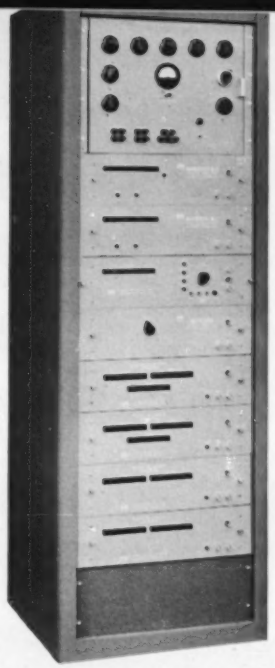
"Computers are to be a basic engineering tool and should be taught as such, not as an appendage. Motivation throughout the undergraduate program comes as an extra dividend.

"Our greatest problem is with our generation who have learned to practice engineering without benefit of computers. We will tend to avoid that which we do not understand and flourish that which we do. We, who are resistant, must struggle to learn that which we know not and feel that we need not.

"Now is the time," concludes Jones, "and the laboratory is the place to plant the seeds of effective future relationships between engineers and computers."

LINKAGE SYSTEM PERMITS COMBINATIONS OF ANALOG, DIGITAL

by DONALD BLOCK,
Packard Bell Computer



This conversion system is available in two basic models. Shown at right is Model DS-113.

MANY ENGINEERING PROBLEMS are encountered in our increasingly complex technology which require solution at speed appropriate to analog computers but with the extreme accuracy and repeatability attainable only with digital devices. By combining the two types of computers into a hybrid system, the advantages associated with each technique can be utilized. The speed of the analog computer, including its ability to solve differential equations in real time, is thus combined with the high resolution, accuracy, and repeatability of the digital computer. In addition, a digital computer permits solution of problems involving logical decisions, the generation of arbitrary function, and computation requiring storage of intermediate results.

Until recently, linkage systems were custom engineered for each application but in an effort to reduce the cost of this approach and to provide relatively quick delivery, a system was developed to permit "plugging together" a standard analog computer and any one of several digital computers without individual engineering. This system, which is now available in two basic standard models, was designed for use with IBM 700-7000 Series, Bendix G-15, and Packard Bell PB 250 computers.

system description

The linkage system comprises three sections, (a) an analog-to-digital conversion system, (b) a buffer register, and (c) a digital-to-analog conversion system.

In the system shown there are three analog-to-digital and three digital-to-analog channels but as many as 30 a-to-d and 30 d-to-a channels can be incorporated without additional engineering because the system is made up of standard Packard Bell Computer digital components. Connectors are included for linking either a PBC PB 250 or a Bendix G-15 to most commercial analog computers. No modification to the system is necessary for use with an IBM 700 or 7000 Series computer – a level changer, the PBC 700 Series computer entry package, is interposed between the IBM computer and the linkage system.

Attenuators permit direct connection of analog computer outputs to the linkage system. These units attenuate the full scale analog voltages to the input range of the multiplexer. An analog-to-digital converter accepts the serial analog output of the multiplexer and converts it to digital form. A digital-to-analog conversion system converts the outputs of the digital computer to analog signals and these are amplified to be suitable for use as analog computer inputs. Control of the system is vested in the most versatile source available – a general purpose digital computer. This type of control provides the programmer with completely flexible means for varying operation of the linkage dependent upon the data received and computations performed.

Transformer coupling isolates the system from the digital computer ground, which keeps the analog computer ground circuits free of any digital computer noise. The hybrid linkage system ground is common with the analog computer ground since many analog functions are performed in the system.

system operation

For purposes of illustration, operation of the hybrid linkage system is described with a Packard Bell PB 250 as the general purpose digital computer. Provisions for operation with a Bendix G-15 or an IBM 704 are also discussed.

PB 250 operation

The computer controls the start of any linkage operation by serially reading out the basic 21 bit operation word into the input register of the linkage system at a two megacycle clock rate. At the completion of the readout the operation mode bits (L 1 and L 2) are decoded to determine which of three possible operations are to be performed by the system.

Operation 1 – Advance the multiplexer to the next channel. Convert the analog information to digital form and transfer the digital data to the input output register of the linkage.

Operation 2 – Preset the multiplexer to the address contained in the address portion of the operation word. Convert the analog information appearing on this channel to digital form and transfer the digital data to the input output register of the linkage.

Operation 3 – Decode the address portion of the operations word to select a digital to analog converter and transfer the digital information in the data portion of the operation word to the digital to analog converter selected.

If operation 1 is called for the address counter (figure 1) is advanced one count. The output of this counter controls the channel selection of the PBCC electronic Multiplexer EM-3. After the necessary delay to allow the multiplexed analog output to become stable a signal to the Multiverter unit begins the conversion cycle. If the information from the analog computer is an a-c signal of frequency greater than a few cycles a second it is necessary to incorporate a Sample and Hold device in the system, when the conversion cycle starts the Sample and Hold is switched into the hold mode. At the end of the conversion the "end of conversion pulse" is used to transfer the newly converted data along with its channel address into the input output register of the linkage and switch the Sample and Hold back to the sample mode. A period of eighty microseconds is necessary from the completion of the readout of the operation word until the data is present in the input output register. The program-

LINKAGE SYSTEM

mer can call for a readout of the data and/or its associated address anytime after this 80 microsecond period.

If operation 2 is called for by the computer, the address portion of the operation word is transferred in parallel to preset the multiplexer address counter. After the necessary delay for the analog output to become stable the Multiverter is signalled to start a conversion. The remainder of the operation is the same as described above with the necessary time for completion of the operation again being 80 microseconds.

In each of the above operations the data is read into the computer serially at the computer formatted clock rate by performing the block serial input command.

If the decoded operation mode bits determine that operation 3 is called for the five bit address portion of the operation word is decoded in the address decoder to select one of 32 possible digital to analog converters. This decoded address is used as a strobe pulse to transfer the contents of the data portion of the operation word to the selected digital-to-analog converter in parallel form. Standard PBCC converters are used for this purpose.

The output of the converter is a plus (+) or a minus (−) 6.667 volt full scale at an impedance of 3.333 kilohms. For this reason operational amplifiers are suggested for use on the output to drive the analog computer.

operation with a G-15 computer

The basic operation of the linkage system with the Bendix G-15 computer is similar to the PB 250. Information enters and leaves the computer serially at a 100 kc rate. Since the G-15 is a much slower operating machine than the PB 250, (one word time is 290 microseconds) several minor changes in the system operation have been incorporated in order to reduce the program time required in the G-15. Use is made of the block serial input gate signal in the G-15 to signify the start of Operation 1. Thus it is not necessary to read an operation word from the computer. This signal is true for the word time that a block serial input is called for. Since the conversion requires 80 microseconds as described above, if the formatted clock signal, which, reads data out of the input register and into the computer, is selected to begin in T9 time or after, the data can be read into the computer in the same word time as it was called for.

To simply accomplish this function it becomes necessary to modify operation 2. To preset the multiplexer an operation word is read from the computer. The mode selection bits (L 1 and L 2) are decoded and if a preset signal for the *Multiplexer* is called for, the number in the address portion of the operation word is transferred to the address counter. A conversion is not started, however, until the block serial input is called for. This signal will then perform operation 1. It can be seen that this modification requires the programmer to preset the address counter to (N-1) if he wants to convert channel N.

Operation 3 is identical with the operation using PB 250 described above.

operation with IBM 704

The system has been designed for use with a real time direct entry package for the IBM 704. Data is transferred to the computer from the input output register and from the computer to the input output register in parallel. When data is transferred by the end of a conversion pulse into the input register a flip-flop is set which activates an input sense line which the computer examines to determine if data is available for read in. When data is read into the computer an output sense line resets the flip-flop. All other operations of the linkage system are the same as described for the PB 250.

advantages of system

By allowing the programmer complete control over the operation of the linkage system many advantages can be achieved in problem solution. If, for example, the data on a particular input exceeds a particular value the programmer might want to change the scanning sequence or rate. Added programming versatility has been included in the system to allow the digital computer to control the mode of operation of the analog computer on hold and stop its operation. This allows the programmer to stop completely during problem solution at any point for close examination should the results seem out of the ordinary.

CIRCLE 102 ON READER CARD

Specifications

General System

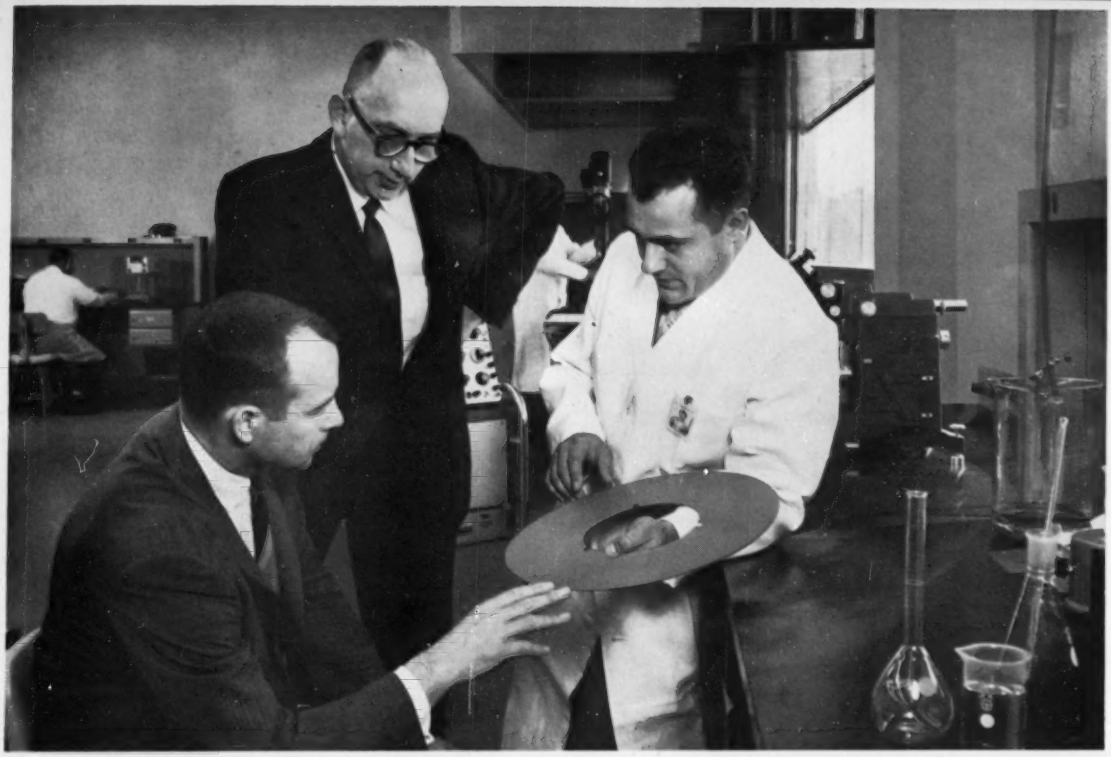
Digital Computers Applicable	PB 250, G-15, IBM 700-7000 Series
Dimensions	72" high by 24" wide by 22" deep.
Grounding	analog and digital grounds are isolated
Power	115 volts, 60 cycles, 250 watts
Temperature Range	30° C ± 15° C
Temperature Coefficient	varies ± 0.004%/°C
Drift Rate	less than ±0.006%/day
External Reference Option	the system reference may be slaved to an external reference source of—100 volts full scale.

Analog-to-Digital Channels

	Model DS-110	Model DS-113
Number of Channels	4 (expandable to 30)	3 (expandable to 30)
Analog Computer Outputs	±100 volts	±100 volts
Linkage System Load	10,000 ohms	10,000 ohms
A-to-D Accuracy	±0.1% (±200 mv)	±0.05% (±100 mv)
A-toD Resoultion	0.05% (100 mv)	0.01% (20 mv)
Multiplex and Convert Time	115 microseconds	75 microseconds
Frequency Without Sample and Hold	1.3 cps	0.7 cps
Frequency With Sample and Hold	140 cps	20 cps

Digital-to-Analog Channels

Number of Channels	4 (expandable to 30)	3 (expandable to 30)
Analog Computer Inputs	±100 volts	±100 volts
Output Impedance	5 ohms	5 ohms
D-to-A Accuracy	±0.1% (±200 m)	±0.05% (±100 mv)
D-to-A Resolution	0.05% (100 mv)	0.01% (20 mv)



The Magnetic Surfacing Pilot Production Area; Mr. H. B. Dickinson, Vice President (left), and Mr. B. Diener (center) and Dr. M. B. Melillo (right) of the Component Development Division.

A Report from American Systems Incorporated...

A New Development in Magnetic Surfacing

In improving the performance and economy of many computing and data handling systems, the surfacing of magnetic memory drums, disks, rods, and tapes tends to be a limiting consideration. Now at American Systems Incorporated, an important new process for surfacing these components is in the pilot production stage. Based on a completely chemical (catalytic) principle, the American Systems process provides magnetic surfaces of greater metallurgical hardness and uniformity than conventional electroplating or spraying. Packing densities are also greater, and higher recording frequencies may be used. Further, the deposition may be controlled so that coercivity and remanence of the surface meet specific application requirements. In the pilot facility, a wide range of component sizes and shapes can be handled simply and rapidly.

Developed by Dr. Manlio Melillo of American Systems Component Development Division, the new process typifies the systems approach to component problems. In addition to magnetic surfacing, the activities of this division encompass component development for computer and communications systems technology.

Front-line technical efforts are also under way at American Systems in six other Divisions:

INFORMATION SCIENCES

Mathematical and statistical research; computer programming, and advanced programming systems; computation services; digital system studies; logical design; advanced systems analysis.

COMMAND AND CONTROL SYSTEMS

Logic of command and control complexes; systems design and development; data acquisition, processing and display; communications.

ELECTROMAGNETIC SYSTEMS

Electromagnetic physics; electronic and mechanical scanning antenna systems; development and manufacturing of special microwave components and complete sensor systems.

RESEARCH LABORATORIES

Solid state physics and systems; magnetic thin-film research and subsystems; advanced components for information processing.

INSTRUMENTS

Research and development in analytical instruments; detection and monitoring of toxic high-energy missile fuel vapors; gas leak and water vapor detection; on-stream and process control instrumentation.

AUDIO-VISUAL

Audio-visual (Instructron) devices for instructional and assembly line applications; production of work stations designed on human factors principles.

These programs are being conducted by an outstanding staff of scientific and technical personnel, over half of whom have advanced degrees. Custom facilities for this work are located in a 27,000-square-foot plant. The first unit in a long range building program, this plant is situated on a 13-acre site.

Qualified scientists and engineers who are interested and experienced in our fields of activity are encouraged to investigate career opportunities with American Systems.

AMERICAN SYSTEMS INCORPORATED

AMERICAN SYSTEMS *Incorporated*

1625 East 126th Street, Hawthorne, California

DATAMATION *news briefs*

LARC COMPLETES NAVY ACCEPTANCE TESTS

LARC has successfully completed acceptance tests at the Applied Mathematics Laboratory, David Taylor Model Basin for Navy's Bureau of Ships. It will be used in carrying out calculations involved in the solution of naval problems in the fields of engineering, research, management data analysis, and operations research. Three-dimensional mathematical models of nuclear reactors will be constructed in the LARC, enabling the design engineer to study and compare varying designs in a highly compressed period of time.

CIRCLE 110 ON READER CARD

TEXAS A&M TO INSTALL FOUR DYSTAC COMPUTERS

The U. S. Army Signal Research and Development Laboratory, Fort Monmouth, N. J., has authorized Texas A & M College to procure a $250,000 general purpose analog computer to be installed at the college's Data Processing Center. The new computer facility to be provided by Computer Systems, Inc., consists of four 5800 Dystac computers. Completion of the installation is anticipated for June 1961.

CIRCLE 111 ON READER CARD

HIGH SCHOOL STUDENTS TAKE COMPUTER COURSE

Twenty-six junior and senior high school students recently completed a 15-week course in high-speed digital computing using an IBM 709. The course, sponsored jointly by the Washington D. C. chapter of the Association for Computing Machinery and the Board of Education of Montgomery Country, Md., is designed to attract talented youngsters to the computing field, and especially to the computer programming profession.

The ACM course covers such topics as the history of computers, the use of binary and octal number systems, analysis of typical problems, fundamentals of programming and applications of computers. The students learned how to program a simple, theoretical computer at first, and then worked up to write programs for the high-speed 709.

THEME SET FOR 1961 EJCC

The theme of the 1961 Eastern Joint Computer Conference will be "Computer – Key To Total Systems Control." The conference is scheduled for the Sheraton-Park Hotel in Washington, D. C., December 12-14. Bruce G. Oldfield, program chairman, stated that this theme reflected one of the most significant trends in modern computer technology. Each person wishing to contribute a paper to the program should submit two copies of both a 100-word abstract and a two-page summary to: Bruce G. Oldfield, IBM Federal Systems Division, 326 E. Montgomery Ave., Rockville, Md.

SIMULATION COUNCILS ELECTS NEW CHAIRMAN

J. E. Sherman, manager of Analog Computing at the Lockheed Missiles and Space Division in Sunnyvale, Calif. has been elected chairman of the board of directors of Simulation Councils, Inc. for 1961. The firm is a non-profit California corporation interested in computers and similar devices which make use of mathematical and physical analogies. There are seven regional councils composed of more than 1200 members.

BELL TEL LAB DEVICE READS HANDWRITING

A small device that reads handwritten words has been built at Bell Telephone Laboratories. It has a ten-word vocabulary – "zero" through "nine," spelled out.

The handwriting reader, about the size of a briefcase, was invented to demonstrate methods which might eventually be applied in machines designed to read a wider variety of material. "Reading machines" could be valuable in any business or industry where information must now be translated into machine language by punched cards, by tape, and by pressing adding machine or typewriter keys. The handwriting reader is an early experimental step in the study of how such machines can be made.

To use the experimental handwriting reader, the writer moves a metal stylus over a special surface just as if he were writing with a pen or pencil. Then, when he touches an "Identify" button with the stylus, a light appears beside the numeral corresponding to the word written.

✓A measure of the success of algebraic computers was attested to recently at a meeting of the Committee on Chemical Engineering on the Bendix G-15 Exchange Conference. It recommended that all members use the ALGO compiler for submitting programs to the Exchange library.

✓The Tape Unit Division of Ampex Corp. will be transferred from its present location at Redwood City, Calif. to the Culver City, Calif. headquarters of Computer Products Co. A target date of November 1, 1961 has been set for completion of the move of equipment and personnel.

✓Minneapolis-Honeywell's Electronic Data Processing Division has signed purchase agreements for acquisition of about 48 acres of land in the Boston

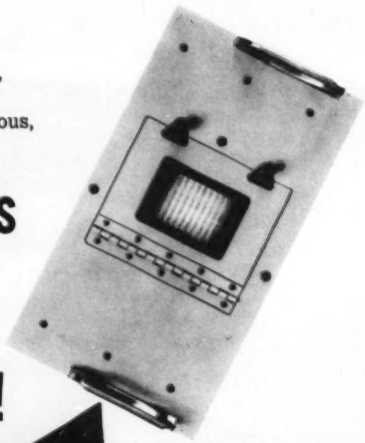
IMPACT OF COMPUTERS ON BEHAVIORAL SCIENCES

During the spring semester of 1960, a lecture series under the general title, "The Impact of Computers of Behavioral Sciences Research," was held at the University of Texas. The following lectures will be reprinted in the Spring, 1961, issue of Educational and Psychological Measurement: "How to Tell Computer from People" by David R. Saunders; "Computer Solutions to Some Non-Computational Psychological Problems" by Robert Siebel; "Simulation of Social Processes and Analysis of Social Structural Data" by James S. Coleman; "Markov and Monte Carlo Models Applied to Decision Making" by Joe H. Ward, Jr.; and "Using Computers to Study Human Perception" by Bert F. Green, Jr. Offprints are available from Department of Educational Psychology, Sutton Hall, The University of Texas, Austin 12, Texas.

This is the Clary Model 2000 series Militarized Printer. This is the one that operates flawlessly... that prints characters in a straight line within .001 inch... it even withstands such severe conditions as a 50g shock of 7 milliseconds duration and 10g's of vibration throughout the frequency range of 2 to 12,000 cycles per second.

Constructed on a sturdy panel for rack mounting, it contains all the necessary electronic equipment for data decoding, digit selections, and control functions. It employs a simple, clean, basic design that makes it adaptable to print the output from a wide variety of devices, including computers, digital voltmeters, shaft position transducers, electronic counters, and digital clocks. In addition, it is ideal in industrial applications where continuous, unfailing operation is required.

this is the printer that can take it!



Clary Model 2000 Series Printer

For complete information on how the Clary Model 2000 series printer can help you, write today for Engineering Bulletin S-120.

Clary CORPORATION
San Gabriel, California

NEW!

Solid State

DISPLAY ASSEMBLY

for decimal display and storage of binary coded decimal data

accepts up to 24 bits of parallel BCD data

Hermes' new Solid State Display Assembly, Model 2060, is designed for use in any system requiring presentation in decimal display of a BCD parallel signal. For example, Model 2060 permits direct reading of Angular Shaft Encoders with BCD parallel output. Model 2060 accepts up to 24 bits of parallel BCD information in any of the following 4-bit Codes: Binary Code Decimal (1-2-4-8); Gray Code (Cyclic Code); Decade Counter Code (1-2-2-4) or (1-2-4-2); Binary Complement Coded Decimal; Binary Two Out of Five Code; Binary (1-2-4-7).

These signals are converted to 60-line decimal display using Burroughs-type Nixie tubes. Binary input to Model 2060 may be either static or parallel pulses.

Storage capability which can conveniently be retrieved through a multi-pin connector is provided in the converting circuitry. Converter Boards can be furnished which accept up to six bits of parallel information, converting to two decimal displays. *Write for Technical Bulletin 2060.*

Hermes

ELECTRONICS CO.

75 CAMBRIDGE PARKWAY, CAMBRIDGE 42, MASS.

A DIVISION OF Itek

CIRCLE 15 ON READER CARD

NEWS BRIEFS . . .

suburb of Billerica. Walter W. Finke, president of the division, said that the company's present plans call for start of a 75,000 sq. ft. manufacturing plant on the track by midsummer.

✓An IBM 1401 has been installed at Brown Engineering Co., Inc. of Huntsville, Ala. The system will be used to speed up production of reports associated with the engineering firm's research and development activities in missile and space programs performed under government contract for Redstone Arsenal.

✓Denver and Rio Grande Western Railroad has completed installation of a Burroughs 220 electronic data processing system at its Denver headquarters. This is the first intermediate scale computer the firm has installed in the Denver area.

CIRCLE 116 ON READER CARD

✓An IBM 7070 and 1401 are the heart of a new computer system installed at the State University of Iowa Computing Center. The new equipment will ultimately replace an earlier model, smaller-capacity, 650, installed in the Center 2½ years ago.

CIRCLE 117 ON READER CARD

✓Eastern Air Lines has ordered a solid-state electronic system to provide customers with information on expected departure and arrival times of planes, availability of seats, and other flight data. The system will consist of two Remington Rand Univac 490 "Real Time" computers and their associated auxiliary equipment. It is scheduled for operation in early 1962.

CIRCLE 118 ON READER CARD

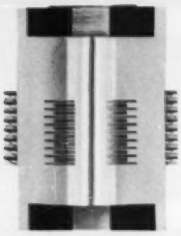
✓CompuDyne Corp. of Philadelphia has more than doubled its analog computer facility. The new facility increases the total computer capacity from 50 to 110 operational amplifiers, 2 to 12 servo multipliers and 2 to 6 function generators. In addition three resolvers are provided.

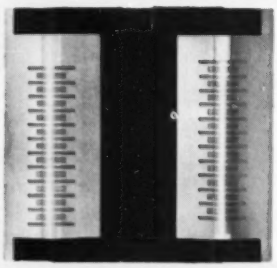
CIRCLE 119 ON READER CARD

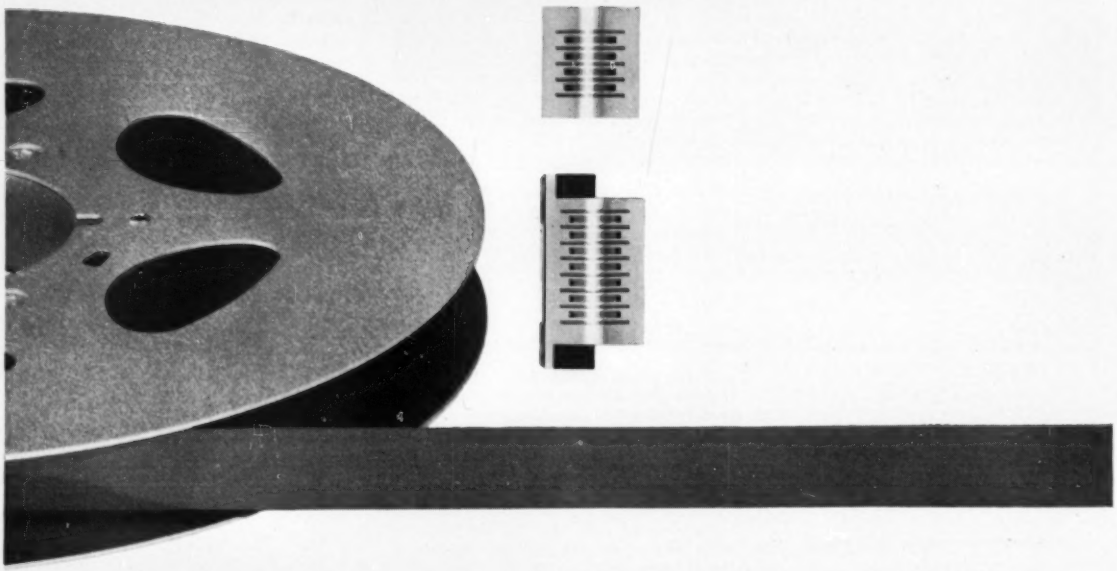
✓Invac Corp., recently organized peripheral data processing equipment firm, has acquired new and enlarged facilities in the East Natick Industrial Park, Mass.

✓Robert Curiel has been appointed assistant manager of ComputerMat, Inc., Los Angeles. He will serve in the position at 1828 Wilshire Blvd., the first of a chain of "Do-it-yourself" computer centers planned by the company. Later this year he will become

standard heads by Brush fill 90% of all Magnetic Head Applications







Why such an all-out claim? Because only Brush has kept pace with the many design requirements in recording technology. Continuous analysis of current and future trends enables us to maintain a design improvement program incorporating all field-proven advances in our *standard* heads. It's a must . . . to satisfy *all* customer requirements. The result? We've been able to standardize and meet all but a few highly specialized applications. You save engineering and testing time . . . and money. If you're one of the few with a "special" problem, Brush obviously has the engineering capability and manufacturing facilities necessary to fulfill *your* magnetic head application. With both standard and special heads, detailed mechanical drawings and specifications plus actual electrical characteristics are available *before the fact.* You can accurately predict system performance without costly time-consuming tests. *Write now for our design and specification bulletin "Optional Characteristic Heads".*

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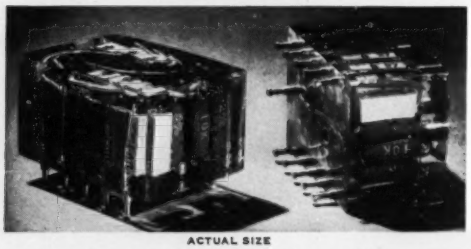
DIVISION OF
37TH AND PERKINS CLEVITE CORPORATION CLEVELAND 14, OHIO

Transistor Logic Elements for Defense

Use these logic modules for easier, faster, computer design

Encapsulated elements operate at high frequency over wide temperature range

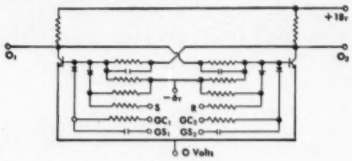
- **Fast switching speed of 1 mc/second**
- **Standard 6 volt logic**
- **Rugged, uniform packaging**



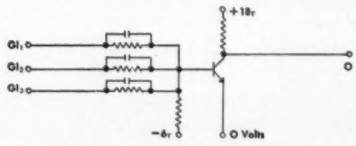
ACTUAL SIZE

Series M Transistor Logic Elements now provide maximum reliability and high frequency performance over an extended temperature range of −40 C to +125 C. Pre-designed for immediate use in breadboard, prototype or production equipment, these compatible logic modules find versatile defense applications in digital computer and data handling systems. Encapsulation in high-temperature epoxy material, semi-transparent for easy inspection of internal assembly, affords protection from extreme environmental conditions of humidity, shock and vibration. Metal feed-through sleeves improve mounting flexibility, while uniform packaging and terminal arrangement facilitate interconnection of modules.

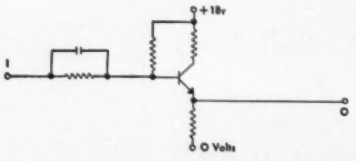
Reasonably priced and available for prompt delivery, General Electric Transistor Logic Elements are manufactured from thoroughly tested, quality components. These saturating and resistance-coupled modules are also offered in circuit and packaging variations, custom designed to meet specific engineering requirements.



Transistor Binary (Type M-264) —provides two gate control inputs, two gate signal inputs, and two direct resistance inputs for the set and reset of the flip-flop. Intended for use in counters and shift registers, it drives up to four, fully loaded, Series M Transistor NOR-Gates at each of the two outputs.



Transistor NOR-Gate (Type M-134) —performs pulse inversion and logic functions OR and AND. Each of the two separate elements of this common emitter switch drives four additional, fully loaded, Series M Transistor NOR-Gates. Three inputs are furnished for each element.



Transistor Emitter Follower (Type M-31-10) — consists of two separate elements with individual input and output terminals. Both elements are capable of driving up to ten, fully loaded, Series M Transistor NOR-Gates. Applications are found in impedance transformation and in driving logic elements without inversion or significant degradation in the transmitted pulse. 176-52

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DEFENSE ELECTRONICS DIVISION

HEAVY MILITARY ELECTRONICS DEPARTMENT • SYRACUSE, NEW YORK

CIRCLE 17 ON READER CARD

NEWS BRIEFS . . .

manager of ComputerMat No. 2 to be located elsewhere in the Los Angeles Area.

CIRCLE 112 ON READER CARD

✓DataService Corp., engaged in certain research and development projects related to EDP and advanced computer techniques, has opened new offices at 11 W. Prospect Ave., Mt. Vernon, New York. Mitchell A. Cotter serves as president of the organization.

CIRCLE 113 ON READER CARD

✓Remington Rand is offering to double the processing speed of existing model 1 File-computers by replacing the present magnetic storage drum with magnetic core memory. The new core storage, which is primarily the same as that of the large-scale Univac III computer system, has a memory capacity of 2000 12-character alpha/numeric words – double that of the present file-computers.

CIRCLE 114 ON READER CARD

✓Systronics, Torrance, Calif., is a new company formed for manufacturing and marketing instruments for the data processing field. Harold V. Nail, former branch manager for Clary Corp., heads the new firm as president. Guy E. Morrison is executive vice president-engineering and research and development. Other officers will be announced at a later date.

CIRCLE 115 ON READER CARD

✓Current Developments In Automatic Data Processing Systems will be the theme of the Eighth Institute on Electronics in Management to be held at the American University, Washington, D.C., from Oct. 30 to Nov. 3, 1961. The institute is designed for management personnel from government, business and industry. For information, write to American Univ., Massachusetts and Nebraska Aves., N.W., Washington 16.

✓The Cleveland-Akron Chapter of the Association for Computing Machinery is scheduled to hold a Computer Conference on Business Languages June 15, 1961. Attendance is by pre-registration only.

✓Frederick M. Hoar has been named director of advertising and public relations for the Univac Division, Sperry Rand Corporation, New York. Hoar was formerly director of publicity and promotions at the Burroughs Corp. in Detroit.

Data Transmission Study Group

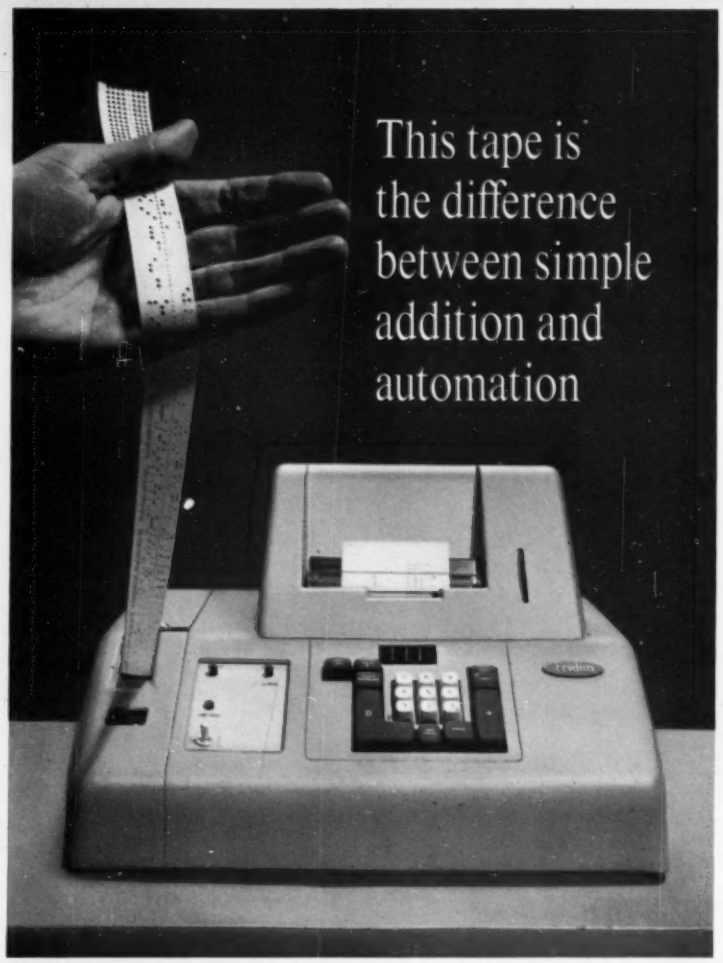
DATAMATION has reported on the Data Transmission Study Group which first met in July, 1960. In attendance were persons from eight major firms in the aerospace industry (Boeing, Convair, Douglas, Hughes, Lockheed, North American, Northrop and SDC) who felt that such a group might promote a better understanding between the users of and the suppliers of communications service and equipment related to the high speed transmission of data. At this initial meeting the objectives of the group were established as follows: 1. Exchange of knowledge; 2. Standardization of terminology to be used; 3. Discussion of total systems requirements; 4. Development of uniform requirements for equipment and service; 5. Forecasting of long range needs; and 6. Acting as a users coordinating group with the common carriers and with equipment manufacturers.

In the meetings to date, members of the Group have focused on high volume information transfers to and from computer centers.

In the area of users coordination, the group has requested and received presentations from common carriers and equipment manufacturers. These presentations were divided into two sessions: Equipment presently available and equipment to be available in the medium and long range future. An attempt was also made by the Group to acquaint the manufacturers with their requirements.

The similarity of digital high speed data communication needs within companies represented in the Group indicates that there is a definite need for integrated communication and data processing equipment and techniques. Several members have mentioned the desirability of being able to communicate analog information (e.g., flight test data) in "real time" to allow decisions to be made while tests are in progress. Others see future needs for high-volume transmission of pictorial information and other information which may be non-digital in its original form. In the future, in its original form.

For further information, contact Justin A. Perlman, manager, Advanced Information Systems Development, Industrial Dynamics, Hughes Aircraft Co., Culver City, Calif.



This is the Friden Add-Punch®, Model ACPT. Like a standard adding machine, it produces a conventional printed tape. But unlike a standard adding machine, it also records complete or selected data in a punched paper tape. Because it does, automated record keeping can be started at the adding machine level—at the source.

With the Add-Punch and the punched paper tape it produces, any size company can get the full benefits of automation. The large firm will save by using the tape for automatic conversion to punched cards (no key punching or verifying is necessary), or for direct input to computers. The small firm without processing equipment can call upon a service bureau to process the tape and to prepare the desired reports at low cost.

The Add-Punch can handle an exceptionally wide variety of accounting and statistical jobs—everything from the entry of basic information at its source to the general ledger.

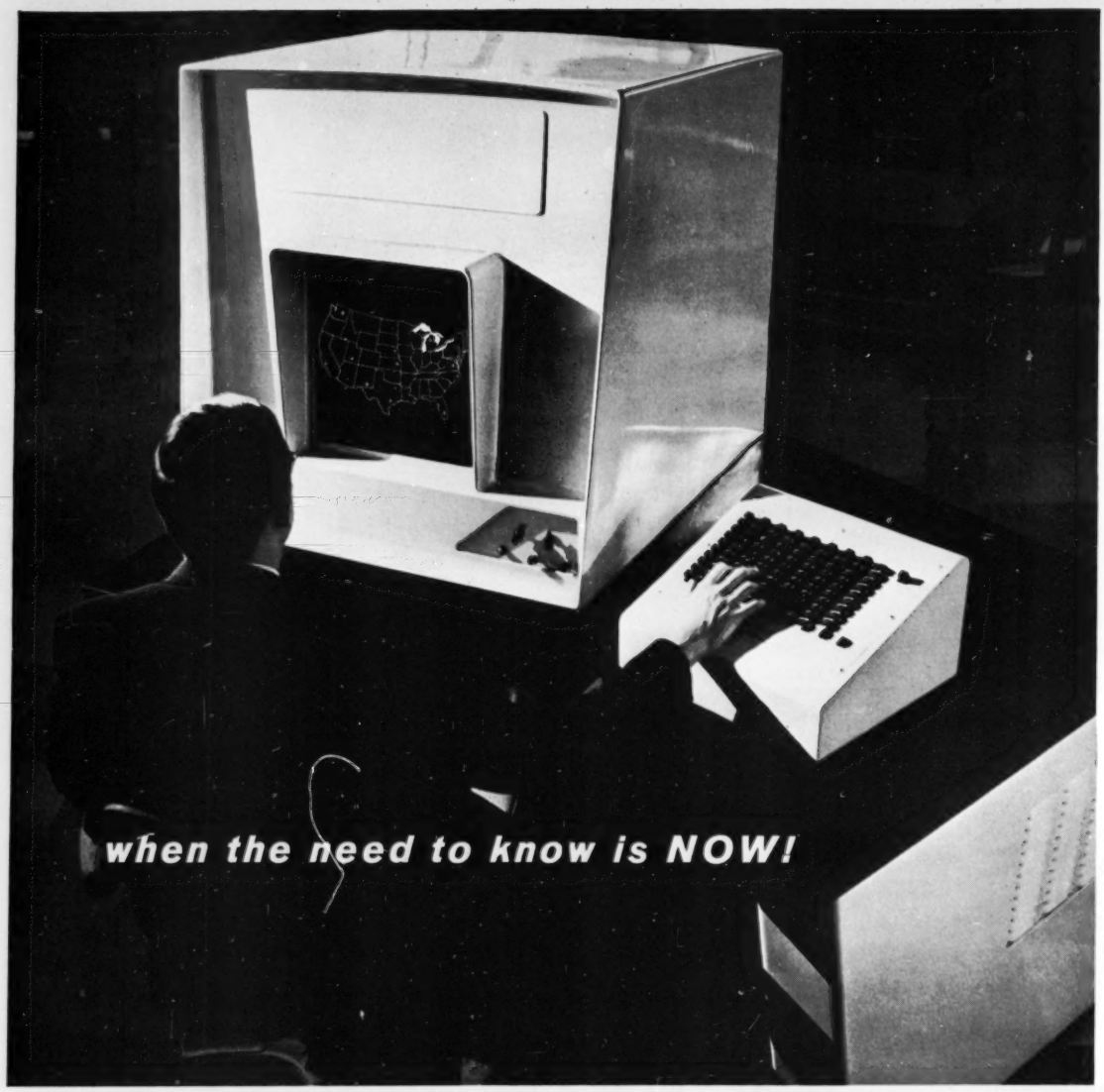
Your Friden Systems Man will be glad to explain how the ACPT can save you money. Call him. Or write: Friden, Inc., San Leandro, Calif.

THIS IS PRACTIMATION: automation so hand-in-hand with practicality there can be no other word for it.

Sales, Service and Instruction Throughout the World

Friden

CIRCLE 18 ON READER CARD



The new LFE SM-2 converts digital computer language into a visual message . . . displays alpha-numeric characters, arbitrary or abstract symbols, schematic or logical drawings, graphs, charts and maps.

Twenty-one inch, flicker-free, display tube clearly displays up to 13,000 character messages, or 90 characters per square inch . . . is easily readable with ordinary office lighting . . . features self-contained storage. Brightness and storage are completely independent of the number of characters on any given page.

SM-2 is readily adaptable to data storage and retrieval systems as the on line output device. Typical of this application is LFE's commercially available RASTAD system.

Other applications include air traffic control, intelligence systems, inventory control, production control, process control monitoring, and other applications where information retrieval and display must be simultaneous. Additional specifications available by writing to Dept. D4.

LFE
COMPUTER PRODUCTS DIVISION

LABORATORY FOR ELECTRONICS, INC.

1079 COMMONWEALTH AVE • BOSTON 15, MASSACHUSETTS

CIRCLE 19 ON READER CARD

DR. WALTER F. BAUER *is manager, Information Systems Department of Ramo-Wooldridge, a division of Thompson Ramo Wooldridge, Inc. He has been a research engineer at the Willow Run Research Center of the University of Michigan and a lecturer in electronic engineering at the University. At the University he worked with the SEAC and MIDAC digital computers. Following this he joined Ramo-Wooldridge Corp. where he became head of the Digital Computer Center. Later he became director of the Computation and Data Reduction Center of Space Technology Labs.*

THE CHAIRMAN AND THE THEME

Most would agree that a theme for a Computer Conference should be simple, powerful in its message, and convey the desired technical emphasis. The 1961 WJCC Committee wished to adopt a conference theme which would emphasize the progress in exploiting and understanding the more technically sophisticated computer functional and design aspects, especially those related to possible or potential human-like qualities of the machine. The Committee decided that the phrase "Extending Man's Intellect" conveyed better than any, the technical program goals of the conference.

But let me be more specific in explaining why this slogan was chosen and what it means. First of all, we believe that the Joint Computer Conferences should be of high technical quality — as academic as we can make them. The importance of this stems from the realization that the Joint Computer Conferences are among the very few opportunities to collect and present top-level scientific information in the computer field. We think it important, therefore, that nothing compromise the technical program.

We have extended man's intellect by making faster, smaller, less expensive, more reliable, and more easily man-communicable computers. The 1961 WJCC technical program, through presentation of the most modern and up-to-date research, will show how we *will* be extending man's intellect; it will show the technical areas in which important progress is being made and will be made in the years to come. For example, our session on "Micro-System Electronics" will deal with the modern techniques in designing and inter-connecting micro-scale components. Our sessions on "Modeling Human Mental Processes," "Problem Solving and Learning Machines," and "Automata Theory and Neural Models" perhaps come closest to giving us visibility in this future extension of man's intellect by computers. Sessions on "Pattern Recognition" and "Information Retrieval" likewise will present sophisticated techniques of growing importance. Other sessions of no less contribution to the conference are "Memory Devices," "Digital Simulation," "Computers in Control," "Automatic Programming," "Large-scale Computers" and analog computer techniques. For each of these sessions we have chosen a Chairman who is expert in the field, and we have asked him to survey the progress in his area. Following this, contributed papers will be presented, papers carefully selected for their quality and appropriateness.

But there is in this conference theme, a much greater implication and a much greater scope. In the implication of "Extending Man's Intellect" we see an eventual greater import and significance of computer accomplishments to civilization than those of space technology or nuclear physics. Indeed, it can be said that man's *ultimate* goal is not to explore the universe, nor to harness unlimited energy, but to build a device equal to or nearly equal to his own mental powers.

Computers have attracted people who are imaginative, creative, and above all, enthusiastic. They are people who are attracted by ideas, logic, and the abstract, rather than the physical or apparent. Also, information processing is, in a strong sense, the common denominator to all intellectual activity. Information handling is fundamental to all intelligent processes; it pervades all higher civilized activities. Few professional fields are, or will be, untouched by the catalyzing effect of electronic computers. Herein lie the strengths of the technology, for information processing, as

THE CHAIRMAN AND THE THEME

a result, is boundless in its appeal and, in the long term, nearly unlimited in its capability.

But the conference theme conveys still another thought. There is every indication that strength in information processing technology will become the symbol of international prestige. Certainly increases in the technology will have a beneficial effect on the economy through increased productivity. In addition, it will be of direct prime importance in the cold war which revolves around strategy and military might. Increasing emphasis is being placed on the country's ability to react quickly to rapidly gleaned, comprehensive information about political or military occurrences. The computer's indisputable pre-eminence as a tool to digest, integrate, summarize and process information, will make it of prime importance in cold war strategy.

Perhaps the reader is moved to wild enthusiasm or deep contemplation by the above thoughts. Or perhaps he writes them off as ravings, platitudes, or generalities. In any event, we have made an industrious attempt for the 1961 WJCC to signal the new revolution in artificial intelligence and implicitly to convey the importance of this in our civilization. We hope that all interested can come, absorb, and enjoy the technical program in an atmosphere of hospitality and friendship which we believe the Conference will provide.

— WALTER F. BAUER

WESTERN JOINT COMPUTER CONFERENCE

KEYNOTE SPEAKER

LUNCHEON SPEAKER

THOMAS J. WATSON, JR., *president of International Business Machines Corporation, will address the Conference on May 9. He has been associated with IBM since 1937. In January 1952 he was elected president of the firm, and in May 1956 he was elected chief executive officer. He is a director of Bankers Trust Company, New York Time, Inc.; member of corporation of Brown University; vice president of National Executive Board, Boy Scouts of America; and trustee of the Air Force Aid Society, American Museum of Natural History, California Institute of Technology, Eisenhower Exchange, and the Thomas Alva Edison Foundation.*

DR. SIMON RAMO *is executive vice president and a director of Thompson Ramo Wooldridge Inc. Prior to the merger with Thompson Products, Inc., Dr. Ramo was executive vice president of The Ramo-Wooldridge Corp., which he and Dr. Dean E. Wooldridge founded in September, 1953. A graduate of the University of Utah and California Institute of Technology, Dr. Ramo has held positions with General Electric's research staff and Hughes Aircraft Company. At Hughes he became vice president and director of operations. He is the author of numerous articles and several books, and is the holder of twenty-five patents.*

WESTERN JOINT COMPUTER CONFERENCE

GENERAL INFORMATION

"Extending Man's Intellect" is the theme of the 1961 Western Joint Computer Conference, scheduled for the Ambassador Hotel, Los Angeles, May 9-11.

Sponsors are the National Joint Computer Committee representing the Institute of Radio Engineers, the American Institute of Electrical Engineers and the Association for Computing Machinery. Attendance is expected to exceed 2,500.

Approximately 70 technical papers will be presented covering subjects including information retrieval, pattern recognition, automata theory and neural models, problem solving and learning machines, automatic programming, modeling human mental processes, computers in control, simulation, computers in communications and large computer systems.

Keynote speaker for the three-day conference will be Thomas Watson, Jr., president of International Business Machines Corporation. He will address the gathering Tuesday, May 9. Dr. Morris Rubinoff, chairman, National Joint Computer Committee, will speak on May 9, following Watson's talk. Dr. Simon Ramo, executive vice-president of Thompson-Ramo-Wooldridge, will be the luncheon speaker May 10. The title of his talk will be "Future Applications of Electronic Intelligence."

The exhibit area will contain 103 booths, occupied by 55 firms. The Sunset Room, the Boulevard Room and Ambassador Ballroom will accommodate an estimated $3 million worth of equipment and displays.

The area opens on May 9 at 12 noon and remains open until 6 p.m. On May 10 the hours are 10 a.m. to 12 noon and 2 p.m. to 9 p.m. On the final day, May 11, the area will remain open from 10 a.m. to 5:30 p.m.

The social highlights of the conference will be the cocktail party and the luncheon. The former is scheduled for Tuesday evening in the Embassy Room. Tickets for both events will be sold for $4.50.

Registration fee for members of the sponsoring societies will be $6. Fee for nonmembers is $10 and students (with identification cards) need pay only $2.

A special conference registration period has been arranged for Monday from 6 to 9 p.m. Located in the lobby of the Ambassador Hotel, registration will be open on May 9 from 7:30 a.m. to 4 p.m.; on May 10 from 8:30 a.m. to 4 p.m.; and on May 11 from 8:30 a.m. to 12 noon. There is no pre-registration.

Conference attendees will not be charged for WJCC proceedings which will be distributed at the time of registration. Additional copies may be ordered at the conference or from any of the sponsoring societies.

Dr. Cornelius T. Leondes, 1961 Program Chairman of the WJCC, has served as research engineer for the Naval Air Development Center, Burroughs Corp. Research Division, and International Business Machines Corp. Presently, he is an Associate Professor of Engineering at UCLA. He joined the faculty in 1956.

His work in industry has been with computers and control systems, parallel digital differential analyzers, and other related fields.

He is a consultant to the Guidance and Control Panel of the Scientific Advisory Board, U.S. Air Force, and has recently been appointed to the Advisory Committee of the Air Force Academy.

Before beginning an analysis of the 1961 WJCC technical program, I would like to thank Paul Armer, J. Don Madden and John McLeod, my associate program chairmen, for their extremely valuable contributions.

I would like to explain, in general terms, how the program was formulated and how we went about making it a reality.

WESTERN JOINT COMPUTER CONFERENCE

PHILOSOPHY OF THE PROGRAM

First of all, that portion of the program dealing with digital computers consists of three basic parts. These are digital computer systems aspects, digital computer applications, and digital computer circuits techniques. The topics presented in each of these groupings were selected so as to underscore the conference theme, and they had to be selected with the constraint of no more than ten half day sessions some of which could be split if necessary to produce additional sessions. Thus rather detailed examination of potential session subjects was carried out by the program and associate program chairmen. It is hoped that the result will be favorably received by the computer industry.

The committee has taken special pains to assure that the program is one of high technical and scientific merit. There have been a number of factors which contributed to the achievement of this goal.

The response to the call for papers was remarkable in the quantity and high quality of the papers received. There were about five times as many papers received as there were places on the program. Practically all the papers received were good to outstanding, and it is hoped that many of the papers which had to be rejected because of space limitations will be published elsewhere in the computer journals.

Secondly, status papers of exceptionally high quality were solicited from acknowledged leaders in the area covered by the respective sessions. Also, generally one additional paper was invited for many of the sessions thus presenting the latest research results by known leading workers in the field. In this manner, adequate freedom for the selection of papers received in answer to the call for papers was provided. At the same time a high quality foundation for the program was guaranteed.

A like procedure was utilized for the three half day sessions on analog computers with somewhat similar results.

The sessions selected for the digital systems and application parts of the program include "Digital Simulation," "Problem Solving and Learning Machines," "Information Retrieval," "Automata Theory and Perceptions," "Automatic Programming," "Pattern Recognition," and "Computers in Control." In addition there will be a special session chaired by Charles W. Adams on "Large Computer Systems." Following an introductory paper for the session on "Trends in the Design of Large Computer Systems" the session will be open to solicited and unsolicited comments from computer manufacturers and research workers in the field. This session is certain to provide many interesting comments.

The sessions selected for the digital computer circuits area include "Microsystem Electronics," "Memory Devices and Components," and "Recent Advances in Computer Circuits." There is no question, for example, that the monolithic blocks which will result from the current active research in the general area of microsystem electronics, or molectronics, or whatever you wish to call it will have a profound and far reaching effect on the computer field. While it may perhaps seem a little early in the game, the program committee as a whole felt that it was far from inappropriate to devote an entire session to this subject at this time. The heavy pressures to develop highly reliable military data processing systems of extended capabilities both for ground based and aerospace vehicle applications will be certain to accelerate the growth of this field such that both startling results and applications will be certain to result in the next several years. The same comments may be made for computer memory devices.

The sessions selected for the analog computer area include "New Hybrid Analog-Digital Techniques," "Applied Analog Techniques," and "The Human Side of Analog Systems." The passing years have demonstrated the increasing scope and power of analog computers in system analysis and synthesis. The sessions at this conference have been selected in order to underscore these trends.

— *C. T. LEONDES*

WESTERN JOINT COMPUTER CONFERENCE

THE PROGRAM

OPENING SESSION
(Session 1 A)
Tuesday, May 9, 1961
Embassy Room, 10:30 a.m.
Keith W. Uncapher, Chairman
The RAND Corporation, Santa Monica, Calif.
Vice-Chairman, Western Joint Computer Conference

WELCOMING ADDRESS — Walter F Bauer
Ramo-Wooldridge Division
Thompson Ramo Wooldridge, Inc.
Canoga Park, California
Chairman, 1961 Western Joint Computer Conference

KEYNOTE ADDRESS — Thomas J. Watson, Jr.
President, International Business Machines Corporation
New York, N.Y.

GENERAL REMARKS — Morris Rubinoff
University of Pennsylvania, Philadelphia, Pa.
Chairman, National Joint Computer Committee

TUESDAY AFTERNOON
May 9, 1961
Session II A
Embassy Room, 2:00 p.m.
DIGITAL SIMULATION
Chairman—H. H. Harman
System Development Corp.
Santa Monica, Calif.

Simulation: A Survey
H. H. Harman, System Development Corporation
Santa Monica, Calif.

Computers and Management Games
J. M. Kibbee, Remington Rand Univac
New York, N.Y.

An On-Line Management System Using English Language
A. Vazsonyi, Ramo-Wooldridge
Canoga Park, California

Application of Digital Simulation Techniques to Highway Design Problems
A. Glickstein, S. L. Levy, Midwest Research Institute
Kansas City, Missouri

The Use of Manned Simulation in the Design of an Operational Control System
M. A. Geisler, W. A. Steger, The RAND Corporation
Santa Monica, Calif.

Session II B
Venetian Room, 2:00 p.m.
MICROSYSTEM ELECTRONICS
Chairman—R. A. Kudlich
A. C. Spark Plug Division of General Motors
El Segundo, California

A Survey of Microsystem Electronics
Peter B. Myers, Semiconductor Products Division, Motorola, Inc., Phoenix, Arizona

Testing of Micrologic Elements
Richard Anderson, Fairchild Semiconductor Corporation, Mt. View, California

Interconnection Techniques for Semiconductor Networks
J. S. Kilby, Texas Instruments, Inc.
Dallas, Texas

Microsystem Computer Techniques
E. Luedicke, A. Medwin, RCA, Camden, N.J.

WEDNESDAY MORNING
May 10, 1961
Session III A
Embassy Room, 9:00 a.m.
MODELING HUMAN MENTAL PROCESSES
Chairman—H. A. Simon
Consultant, The RAND Corporation
Santa Monica, California, and
Carnegie Institute of Technology
Pittsburgh, Pennsylvania

Introduction: Modeling Human Mental Processes
H. A. Simon, Carnegie Institute of Technology
Pittsburgh, Penn.

The Simulation of Verbal Learning Behavior
E. Feigenbaum, University of California
Berkeley, California

The Simulation of Behavior in the Binary Choice Experiment
J. Feldman, University of California
Berkeley, California

Programming a Model of Human Concept Formulation
C. I. Hovland, E. B. Hunt, Yale University
New Haven, Connecticut

Session III B
Venetian Room, 9:00 a.m.
RECENT ADVANCES IN COMPUTER CIRCUITS
Chairman—C. T. Leondes
University of California
Los Angeles, California

Parallelism in Computer Organization Random Number Generation in the Fixed Plus Variable Computer System
M. Aoki, G. Estrin, University of California
Los Angeles, California;
T. Tang, National Cash Register Company
Hawthorne, California

The CELLSCAN System — a Leucocyte Pattern Analyzer
Kendall Preston, Jr., Perkin-Elmer Corporation
Norwalk, Conn.

Application of Computers to Circuit Design for UNIVAC LARC
G. Kaskey, N. S. Prywes, H. Lukoff, Remington-Rand Univac
Philadelphia, Penn.

Wide Temperature Range Coincident Current Core Memories
R. S. Weisz, N. Rosenberg, Ampex Computer Products Company; Culver City, California

Tunnel Diode Balanced Pair Circuit as a Building Block for High-Speed Computers
W. E. Barnette, G. A. Brown, S. Fiarman, H. S. Miller, R. A. Powlus
RCA Laboratories, Princeton, New Jersey

Session IV A—Embassy Room, 10:45 am.
PROBLEM SOLVING AND LEARNING MACHINES
Chairman—Marvin Minsky
Massachusetts Institute of Technology
Cambridge, Massachusetts

Descriptive Languages and Problem Solving
Marvin Minsky, Massachusetts Institute of Technology
Cambridge, Massachusetts

Baseball: An Automatic Question-Answerer
Bert F. Green, Jr., Alice K. Wolf, Carol Chomsky, Kenneth Laughery
Massachussets Institute of Technology, Lexington, Massachusetts

A Basis for a Mathematical Theory of Computation
John McCarthy, Massachusetts Institute of Technology
Cambridge, Massachusetts

CONFERENCE LUNCHEON
Wednesday, May 10, 1961
Coconut Grove, 12:15 p.m.
Master of Ceremonies
Walter F. Bauer, Chairman, 1961 WJCC
Invited Speaker—Simon Ramo
Executive Vice-President
Thompson Ramo Wooldridge, Inc.
"Future Applications of Electronic Intelligence"

WEDNESDAY AFTERNOON
May 10, 1961
Session V A
Embassy Room, 2:00 p.m.
INFORMATION RETRIEVAL
Chairman—Don R. Swanson
Ramo-Wooldridge; Canoga Park, California

Information Retrieval: State of the Art
Don R. Swanson, Ramo-Wooldridge
Canoga Park, California

Technical Information Flow Pattern
M. M. Kessler, Massachusetts Institute of Technology
Lexington, Massachusetts

A Screening Method for Large Information Retrieval Systems
Robert T. Moore, Princeton University and
The National Bureau of Standards, Washington, D.C.

Session V B
Venetian Room, 2:00 p.m.
AUTOMATA THEORY AND NEURAL MODELS
Chairman—Peter M. Kelley
Aeronutronic
Newport Beach, California
Session Arranged by Heinz von Foerster
University of Illinois; Urbana, Illinois

What is an Intelligent Machine?
W. Ross Ashby, Visiting Research Professor
University of Illinois, Urbana, Illinois

Physiology of Automata
Murray L. Babcock, University of Illinois
Urbana, Illinois

Analysis of Perceptrons
H. D. Block, Cornell University
Ithaca, New York

Session V C
Colonial Room, 2:00 p.m.
NEW HYBRID ANALOG-DIGITAL TECHNIQUES
Chairman—G. A. Korn
University of Arizona; Tucson, Arizona

Hybrid Analog-Digital Computers
Hermann Schmid, Link Division
General Precision, Inc., Binghamton, New York

Optimization of Linear System Dynamic Characteristics
C. H. Single, E. M. Billinghurst, Berkeley Division,
Beckman Instruments, Inc., Richmond, California

Design and Development of a Sampled-Data Simulator
J. E. Reich, J. J. Perez, Space Technology Laboratories, Inc.
Los Angeles, California

Digital Control Systems for a Repetitive Electronic Analog Computer
T. Brubaker, H. Eckes, University of Arizona
Tucson, Arizona

Session VI A
Embassy Room, 3:45 p.m.
LARGE COMPUTER SYSTEMS

Chairman—C. W. Adams
Charles W. Adams Associates
Bedford, Mass.

Trends in Design of Large Computer Systems
C. W. Adams, Charles W. Adams Associates

THURSDAY MORNING
May 11, 1961
Session VII A
Embassy Room, 9:00 a.m.

AUTOMATIC PROGRAMMING
Chairman—Ascher Opler
Computer Usage Company
New York, N.Y.

Current Problems in Automatic Programming
Ascher Opler, Computer Usage Company

A First Version of UNCOL
T. B. Steel, Jr., System Development Corporation
Santa Monica, California

Method of Combining Algol and Cobol
J. E. Sammet, Sylvania Electric Products
Needham, Massachusetts

ALGY — An Algebraic Manipulation Program
M. D. Bernick, E. D. Callender, J. R. Sanford, Philco Corporation, Palo Alto, California

A New Approach to the Functional Design of a Digital Computer
R. S. Barton, Computer Consultant
Altadena, California

The JOVIAL Checker
M. Blauer, System Development Corporation,
Paramus, New Jersey

Session VII B
Venetian Room, 9:00 a.m.
MEMORY DEVICES AND COMPONENTS
Chairman—P. V. Levonian
Space Technology Laboratories, Inc.
Los Angeles, California

Factors Affecting Choice of Memory Elements
Claude F. King, Claude King Associates
Los Angeles, California

A Nondestructive Readout Film Memory
Richard J. Petschauer, Rodney D. Turnquist, Remington Rand Univac, St. Paul, Minnesota

Tunnel Diode Storage Using Current Sensing
E. R. Beck, D. A. Savitt, A. E. Whiteside
Bendix Corporation Research Laboratories Division
Detroit, Michigan

The Development of a New Nondestructive Memory Element
A. W. Vinal, Federal Systems Divisions, IBM
Owego, New York

A High Speed Metastable Memory Element and Pulse Delay Line
Lewis C. Clapp, Computer Development Laboratory
Sylvania Electronics Systems, Needham, Massachusetts

Session VII C
Coconut Grove, 9:00 a.m.
APPLIED ANALOG TECHNIQUES
Chairman—R. R. Favreau
Electronic Associates, Inc.
Long Branch, New Jersey

The Optimization of Radar Designs Using GEESE Techniques
E. L. Berger, General Electric Defense Systems Department, Syracuse, New York

The Spectral Evaluation of Iterative Differential Analyzer Integration Techniques
Max Gilliand, Berkeley Division, Beckman Instruments, Richmond, California

An Iteration Procedure for Model Building and Boundary Value Problems
Walter Brunner, Consultant to Electronic Associates
Princeton Computation Center, Princeton, New Jersey

Analog Simulation of Underground Water Flow in the Los Angeles Costal Plain
D. A. Darms, Electronic Associates Los Angeles Computation Center, Los Angeles, California

THURSDAY AFTERNOON
May 11, 1961
Session VIII A
Embassy Room, 2:00 p.m.

PATTERN RECOGNITION
Chairman—O. Selfridge
Lincoln Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

Pattern Recognition
F. C. Frick, Massachusetts Institute of Technology
Cambridge, Massachusetts

A Self-Organizing Recognition System
P. M. Kelley, R. J. Singer, Aeronutronic
Newport Beach, California

A Learning Program for Pattern Recognition
L. Uhr, University of Michigan
Ann Arbor, Michigan;
C. Vossler, System Development Corporation
Santa Monica, California

An Experimental Program for the Selection of Disjunctive "Hypotheses"
M. Kochen, International Business Machines Corp.
Yorktown, New York

Time-Analysis of Logical Processes in Man
U. Neisser, Brandeis University, Waltham, Mass.

Session VIII B
Venetian Room, 2:00 p.m.
COMPUTERS IN CONTROL
Chairman—A. J. Rowe
Hughes Aircraft Company
Culver City, California

Computer-Based Management Control
A. J. Rowe, Hughes Aircraft Company
Culver City, California

American Airlines "SABRE" Electronic Reservations System
M. N. Perry, W. R. Plugge, American Airlines
New York, N.Y.

Real-Time Management Control at Hughes Aircraft
D. R. Pardee, Hughes Aircraft Company
Culver City, California

Project Mercury—Command—Control Program System
B. G. Oldfield, International Business Machines Corp.
Rockville, Maryland;
A. M. Pietrasanta, International Business Machines Corp.
Washington, D.C.

The 465L (SACCS) Computer Application
P. D. Hildebrandt, System Development Corporation
Lexington, Massachusetts

Session VIII C
Coconut Grove, 2:00 p.m.
THE "HUMAN" SIDE OF ANALOG SYSTEMS
Chairman—L. A. Ohlinger
Norair; Hawthorne, California

The Computer Simulation of a Colonial, Socio-economic Society
Warren Dee Howard, Defense Systems Division
General Motors Corporation, Warren, Michigan

X-15 Analog Flight Simulation — Systems Development and Pilot Training
Norman Cooper, North American Aviation, Inc.

Analog-Digital Hybrid Computers in Simulation with Humans and Hardware
Owen F. Thomas, Simulation and Computer Center
U.S. Naval Ordnance Test Station, Pasadena, Calif.

The Automatic Determination of Human and Other Systems Parameters
T. F. Potts, G. N. Ornstein, A. B. Clymer,
North American Aviation, Inc., Columbus, Ohio

WESTERN JOINT COMPUTER CONFERENCE

CONFERENCE PLANNERS

Arrangements committee chairmen for the WJCC discuss final plans for the May 9-11 meeting in Los Angeles. Left to right, standing: John Whitlock, exhibits management; Santo Lanzarotta, public relations chairman, Datamation Magazine; Smil Ruhman, associate program chairman, Packard Bell Computer Division; L. C. Hobbs, print chairman, Aeronutronic Division of Ford Motor Company; Marvin Howard, registration chairman; Thompson Ramo Wooldridge, Inc.; William Speer, finance, United Aircraft Corp.; seated, left to right, J. D. Madden, associate program chairman, System Development Corp.; R. H. Hill, exhibits chairman, Thompson Ramo Wooldridge, Inc.; Dr. R. W. Rector, conference administrator, Space Technology Laboratories; Dr. Walter F. Bauer, general chairman of the 1961 meeting, Thompson Ramo Wooldridge, Inc.; Keith Uncapher, conference vice chairman, The Rand Corp., and R. D. Aeder, publications chairman, IBM Corp.

WOMEN'S ACTIVITIES

A full schedule of events is planned for the ladies at the 1961 Western Joint Computer Conference. Beginning at 10 a.m. on May 9 with a Get-Acquainted Coffee Hour, the wives of conference attendees will have opportunities to tour movie and television studios, attend panel discussions plus luncheon and cocktail hours.

Under the chairmanship of Mrs. Phyllis Huggins of Bendix Computer Division, a panel discussion is scheduled for May 9, at 11 a.m. The panel, consisting of Vincent van Praag, president, Electro-Logic Corp., Jackson W. Granholm, editor, Computing News, and George G. Vosatka, western regional manager, Bendix Computer Division, will discuss new uses of computers and how they may affect the housewife.

Following the panel discussion will be a cocktail hour with husbands invited, and luncheon in the Portofino Room. The afternoon has been left free of activities to provide time to visit the exhibit area.

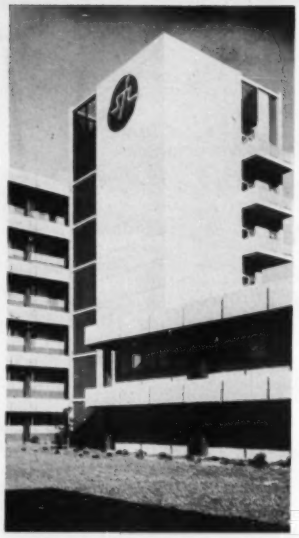
On Wednesday, May 10, a tour of motion picture and telvision studios, and stars' residences is scheduled. The tour, scheduled for a 10 a.m. departure, will cost $2 for bus service, plus the price of lunch in the studio commissary.

There are no planned ladies activities for Thursday, May 11.

There will be a special women's activities desk at the WJCC for those who wish to make arrangements for any of the planned trips. Tickets will be available at the desk for the following television programs: Art Linkletter Show, Angel, It Could Be You, and Truth or Consequences.

All reservations should be made at least one day in advance, and may be arranged prior to the conference by contacting Mrs. Phyllis Huggins, Bendix Computer Division, 5630 Arbor Vitae St., Los Angeles.

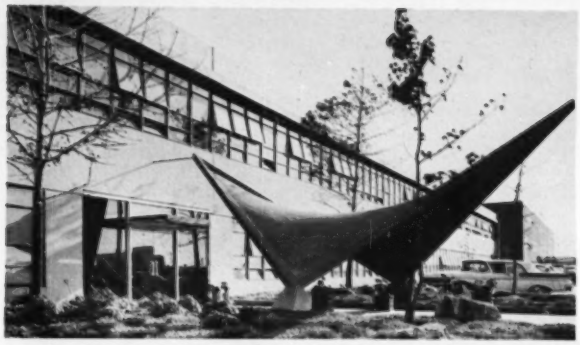
Besides Mrs. Huggins, the Women's Committee is composed of: Mrs. Robert Rector; Mrs. Keith Uncapher; Mrs. J. Don Madden; and Mrs. Walter Bauer.



Space Technology Laboratories

WESTERN JOINT COMPUTER CONFERENCE

System Development Corporation



FIELD TRIPS

Ampex Computer Products Company

1 SPACE TECHNOLOGY LABORATORIES

2 SYSTEM DEVELOPMENT CORPORATION

3 AMPEX COMPUTER COMPANY

Space Technology Laboratories, System Development Corp., and Ampex Computer Products Company have been selected as field trip sites during the 1961 WJCC. All three tours, scheduled for May 10, will depart from the Ambassador Hotel at 7 p.m.

Included in the tour of Space Technology Labs (Trip No. 1) will be two IBM 7090 computers with associated card-to-tape and tape-to-printer equipment at the Computer Center; the tracking operations for the Explorer VI and Pioneer V were carried out at the Space and Navigation Center, another stop on the tour; the Computation and Data Reduction Center; and the research laboratory where experiments with cryogenic thin film elements will be on exhibit.

Trip No. 2, System Development Corporation, will feature the AN/FSQ-7 electronic digital computer system; a demonstration of the SAGE system training problem production facility; and a talk by Harry Harmon, manager of the research laboratory, on "Simulation at SDC." James Watson will act as host.

The third trip offered, Ampex Computer Products Company, will highlight the display of high speed magnetic core memories and digital tape handlers in the Core Memory Division; a demonstration of magnetic cores manufactured from ferrite materials, tested and strung into arrays in the Components Division; and a talk by C. Helms, manager of Commercial Engineering, on "The High Speed Magnetic Core Memory." Host for the tour will be Gene McClenning, director of public relations for the firm.

The price of each trip is $2, and the number of visitors is limited to 80 for each tour. Tickets will be available only from the registration desk at the Western Joint Computer Conference.

Directing the activities of these trips is chairman Joel Herbst, Ampex Computer Products Company.

Aeronutronic Div., ... **49-50**
Ford Motor Co.
Computer Products Operation
Ford Road
Newport Beach, Calif.

Ampex Computer Products **61-62**
(Including Telemeter Magnetics) **63-64**
934 Charter Street
Redwood City, Calif.

Ampex Magnetic Tape Products ... **65**
P.O. Box 190
Opelika, Ala.

Anelex Corporation **93-94**
150 Causeway St.
Boston, Mass.

Applied Development Corp. **95**
12838 Weber Way
Hawthorne, Calif.

Autonetics, A Div. of
North American Aviation, Inc. **1**
9150 East Imperial Highway
Downey, Calif.

Automatic Electric Division **6**
General Telephone Co.
63 Second Ave.
Waltham 54, Mass.

Berkeley Div. of
Beckman Instruments, Inc. **44**
2200 Wright Ave.
Richmond, Calif.

Bryant Computer Products **82-83**
Div. of Ex-Cell-O Corp.
850 Ladd Road
Walled Lake, Michigan

Burroughs Corporation **27-28-29**
6071 Second Avenue
Detroit 32, Michigan

California Computer Products Co.... **3-B**
8714 Cleta Street
Downey, Calif.

C. P. Clare and Co. **46**
6047 Hollywood Blvd.
Los Angeles 28, Calif.

Clary Corporation **21**
408 Junipero St.
San Gabriel, Calif.

Computer Control Co., Inc. **37-38**
2251 Barry Avenue
Los Angeles 64, Calif.

Computronics, Inc. **71**
5310 E. Pacific Place
Denver 22, Colorado

Consolidated Electrodynamics
Corporation **41-42**
360 N. Sierra Madre Villa
Pasadena, California

Control Data Corporation **96-97**
501 Park Avenue
Minneapolis 15, Minn.

DATAMATION **3-A**
F. D. Thompson Publications Inc.
10373 West Pico Blvd.
Los Angeles 64, Calif.

Digital Equipment Corp. **80-81**
146 Main Street
Maynard, Mass.

Digitronics Corp. **90-91-92**
Albertson Avenue
Albertson, L.I., New York

Dynacor, Inc. **11**
1010 Westmore Avenue
Rockville, Md.

Electro-Logic Corp. **60**
515 Boccacio Ave.
Venice, Calif.

Electronic Engineering Co.
of California **17**
1601 E. Chestnut Ave.
Santa Ana, Calif.

Engineered Electronics Co. **101-102**
1441 E. Chestnut St.
Santa Ana, Calif.

Engineers

APPETIZERS

PROGRAMMERS/SYSTEMS ANALYSTS — $15,000
Math deg + exp with large scale computers as IBM 7070; 7090; Philco 2000; Honeywell 800 etc.

MATHEMATICIANS — $13,000
Adv. deg. or training in Applied Math and Digital Computation. Opportunity to develop solutions of Math & Engr'g problems.

SOUPS

PROGRAMMING PLANNERS — To $15,000
Math/Stat/EE deg + 1 yr programming for magnetic tape computers.

MANAGER/ADMINISTRATOR — To $13,000
Deg + exp in programming; control of programming and scheduling.

ENTREES

DEPARTMENT MANAGER — $20,000
Deg nec. To supervise digital computers; logical designers; component and circuit personnel.

SYSTEMS ANALYSTS — $20,000
EE/Math deg + related exp. For analysis of data to develop comprehensive systems.

EDP PROGRAMMERS — $16,000
BS deg + proven exp in programming on management control and business system projects on advanced computing equipment.

SALADS

SYSTEMS ANALYSTS
MA Math/Physics/EE in areas of: Information theory; communication theory; speech transmission and radar.

DATA ANALYSTS
Physics/EE/Math deg. — Seniors & Juniors.

DESSERTS

PROGRAMMERS/SYSTEMS ANALYSTS
BS/MS/Math Deg + exp in digital programming; systems error analysis; flight simulation programming and analysis; rockets; missiles; space vehicles.

GROUP LEADER — DIGITAL COMPUTING
BSEE/Math/Physics deg + min of 3 yrs exp in digital programming and operation.

BENNETT ASSOCIATES
•
18TH FLOOR, COMMERCIAL TRUST BUILDING
PHILADELPHIA, PA.

Fairchild Semiconductor Corp. 39-40
545 Whisman Road
Mountain View, Calif.

Ferranti Electric, Inc. 43
95 Madison Ave.
Hempstead, New York

Friden, Inc. 84-85-86
2350 Washington Ave.
San Leandro, Calif.

General Electric 35
Information System Section
4901 Fairmont
Bethesda, Md.

General Electric 36
Light Military Electronics Dept.
600 Main St.
Johnson City, New York

Genesys 45
10131 National Blvd.
Los Angeles 34, Calif.

International Business
Machines Corp. 54-55
590 Madison Ave. 56-57
New York 22, New York

Laboratory for Electronics, Inc. .. 73-76
1097 Commonwealth Ave.
Boston, Mass.

Librascope Div., ... 68-69
General Precision, Inc.
808 Western Ave.
Glendale, Calif.

Monroe Calculating
Machine Co., Inc. 47-48
555 Mitchell St.
Orange, New Jersey

Moxon Electronics 87
489 S. Robertson Blvd.
Beverly Hills, Calif.

The National Cash Register Co... 78-79
Main and K Streets 88-89
Dayton 9, Ohio

Pacific Telephone & Telegraph .. 66-67
740 S. Olive St.
Los Angeles 55, Calif.

Packard Bell Computer Corp. .. 99-100
1905 Armacost Ave.
Los Angeles 25, Calif.

Philco Corporation
G and I Group 32-33-34
Computer Division 51-52-53
4700 Wissahickon Ave.
Philadelphia 44, Pa.

Photocircuits Corp. 98
31 Sea Cliff Ave.
Glen Cove, New York

Potter Instrument Co., Inc. 15-16
Sunnyside Blvd.
Plainview, L.I., New York

Ramo-Wooldridge, a Div. of
Thompson Ramo Wooldridge.. 12-13-14
8433 Fallbrook Ave.
Canoga Park, Calif.

Recordak Corp 58-59
Wanamaker Place
New York 3, New York

Reeves Soundcraft Corp. 77
Great Pasture Road
Danbury, Conn.

Remington Rand Univac 72-73-74
Div. of Sperry Rand Corp.
315 Park Avenue South
New York 10, New York

Rese Engineering, Inc. 2
A and Courtland St.
Philadelphia 20, Pa.

Rheem Semiconductor Corp 30-31
350 Ellis St.
Mountain View, Calif.

Royal McBee Corp. 66-67
Westchester Ave.
Port Chester, New York

Sprague Electric Co. 9-10
97 Marshall St.
North Adams, Mass.

Stromberg-Carlson-San Diego. 24-25-26
1895 Hancock St.
San Diego 12, Calif.

Sylvania Electronic Systems 4-5
63 Second Avenue
Waltham 54, Mass.

Tally Register Corp. 8
1310 Mercer St.
Seattle 9, Wash.

Telex Corp. 60
Telex Park
St. Paul, Minn.

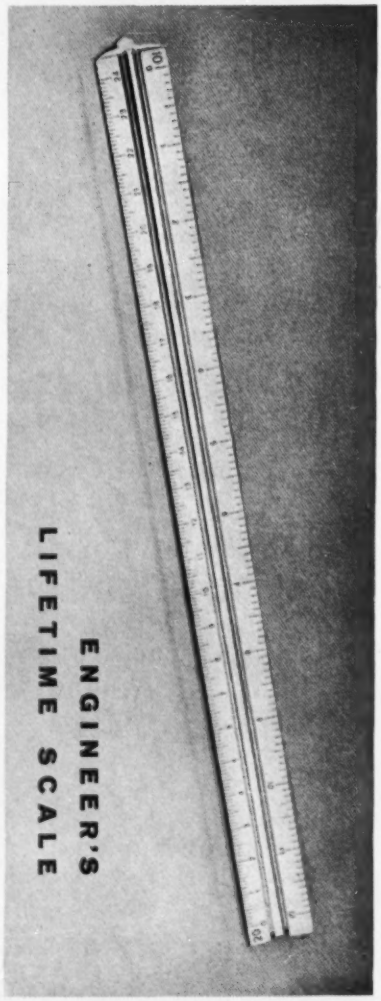
Texas Instruments, Inc. 22-23
P.O. Box 312
Dallas 21, Texas

Walkirt Co. 70
141 W. Hazel St.
Inglewood, Calif.

John Wiley & Sons, Inc. 7
440 Park Avenue South
New York 16, New York

Menu

COMPLIMENTS OF THE HOUSE



$16,000

$7-11,000

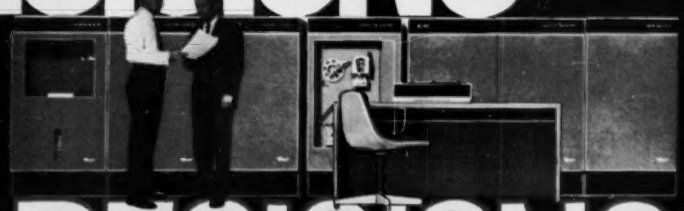
Sal. WIDE OPEN

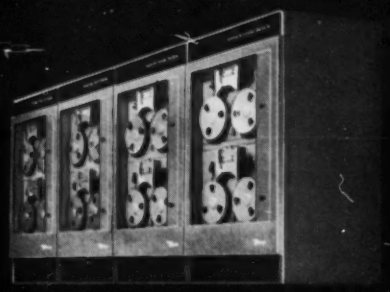
$12,500

CIRCLE 72 ON READER CARD

FOR BENDIX COMPUTER CIRCLE 20 ON READER CARD

DECISIONS





DECISIONS

Better Management with the Bendix G-20 Computer

Is this your company? The engineers pick the very best designs from hundreds of possibilities... the controller reacts to financial changes in hours instead of weeks... the production manager maintains near-perfect inventories and schedules... the distribution system is truly optimized... the advertising manager is sure he has picked the right media... and the president takes fast but sound action based on a concise daily operating report.

Dream-stuff? No sir, these and many other advanced executive decisions are possible **now** with the Bendix G-20 computing system . . . combined with operations research techniques and improved data collection methods.

Your own engineers and systems analysts, or any of the many competent management consultants who know computers can tell you why. They know the techniques needed to help make management decisions . . . The speed, low-cost and simplified use of the G-20 now make it practical to **apply** these techniques. Ask them . . . or write to us. We can **prove** that using a Bendix G-20 can be the best decision you ever made.

Call the nearest Bendix Computer office, or write

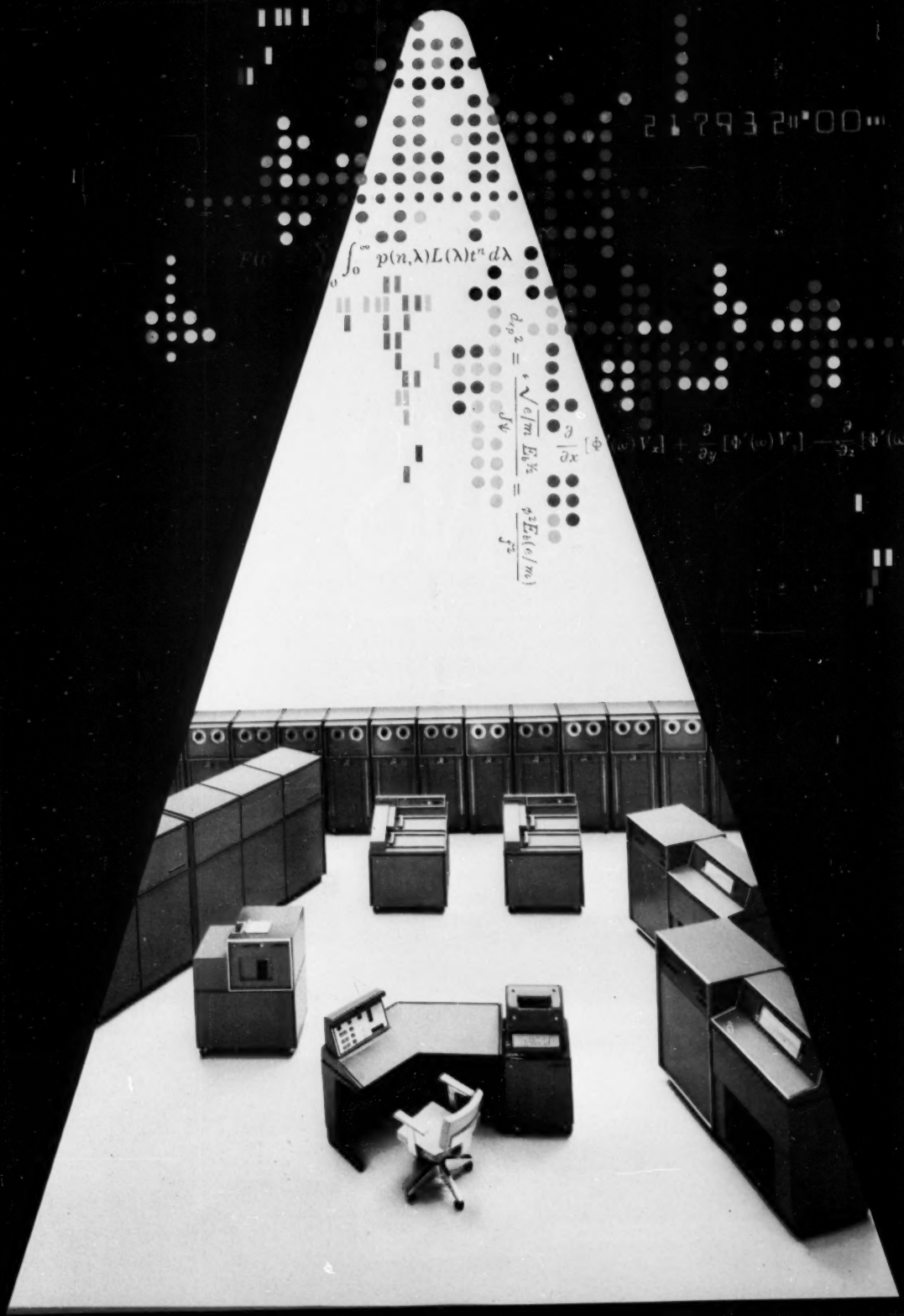
Bendix Computer Division

DEPT. E-31, LOS ANGELES 45, CALIFORNIA

THE Bendix CORPORATION

BURROUGHS CORPORATION ANNOUNCES

THE B 5000, WHICH SETS NEW STANDARDS IN


$\int_0^\infty p(n,\lambda)L(\lambda)t^n d\lambda$
$d_{\nu_2}{}^2 = \frac{\sqrt{e/m}\,E_{\nu_2}}{N\nu} = \frac{\nu^2 E_0(e/m)}{\nu_2^2}$
$\frac{\partial}{\partial x}[\Phi'(\omega)V_x] + \frac{\partial}{\partial y}[\Phi'(\omega)V_y] - \frac{\partial}{\partial z}[\Phi'(\omega)V_z]$

...S IN PROBLEM SOLVING & DATA PROCESSING

The new Burroughs B 5000 Information Processing System is a decided departure from conventional computer concepts. It is a problem-oriented system. Its markedly different logic and language are in large part dictated by the characteristics of ALGOL and COBOL. And it incorporates a complete set of operating, monitoring and service routines.

Additional operational features include an average add execution time of three microseconds, and a memory cycle time of six microseconds. Both character- and word-oriented, the B 5000 operates in binary *and* alphanumeric modes; a single set of arithmetic commands operates interchangeably on both fixed-point and floating-point numbers.

More important than these features is the fact that they combine with compiler-oriented logic and language to provide a new concept in computing—an integrated hardware-software system which sets:

NEW STANDARDS OF PROGRAMMING EFFICIENCY

Incorporating logic and language designed to take advantage of modern compiler techniques, the B 5000 permits straightforward, efficient translation of common-language source programs. And it brings a new high in compilation speeds—20 to 50 times faster than those possible on conventional computer systems.

NEW STANDARDS OF AUTOMATIC OPERATION

A Master Control Program, incorporating the automatic operating, monitoring and service routines, is pre-stored on a fast-access drum. It automatically schedules work according to pre-assigned priorities; allocates memory and input/output assignments; and maintains maximum-efficiency use of all components through a comprehensive interrupt system. As a result, human intervention is minimized, system efficiency maximized.

NEW STANDARDS OF PROGRAM-INDEPENDENT MODULARITY

Availability of multiple, functionally independent modules provides the B 5000 with excellent system flexibility and expansibility. The system may include one or two independent processors; up to eight core memory modules with a total capacity of 32,768 48-bit words; and one or two fast-access bulk storage drums, each with a capacity of 32,768 words. Up to four independent input/output channels control a maximum of 26 input/output units, including up to 16 standard-format magnetic tape units. Additional input/output units include card punch and reader, two types of printer, plotter and keyboard.

NEW STANDARDS OF EFFECTIVE MULTI- AND PARALLEL PROCESSING

The Program Independent Modularity of the B 5000, combined with the automatic scheduling and control features of the Master Control Program, permits multi-processing—the B 5000's normal mode of operation. The addition of a second functionally independent processor provides true parallel processing ability.

NEW STANDARDS OF SYSTEM COMMUNICATION

The new B 5000 permits simultaneous on-line/off-line operation. It features completely flexible communication among all of its units. A central processor communicates with all memory units. Any input/output channel communicates with any peripheral equipment and any memory module.

NEW STANDARDS OF THROUGH-PUT PER DOLLAR

All of these B 5000 features combine to provide an important new standard of through-put—the maximum amount of work in the shortest possible time, using the fewest possible components. The result is large-scale performance in the medium-price range.

For details in depth on the B 5000, call our nearby office. Or write for a copy of "The B 5000 Concept" to Data Processing Division, Burroughs Corporation, Detroit 32, Michigan.

Burroughs–TM

Burroughs Corporation

"NEW DIMENSIONS / in electronics and data processing systems"

CIRCLE 21 ON READER CARD

AROUND THE WORLD IN COMPUTING

by G. PATRICK ANDERSON and ETIENNE J. GUERIN

West Germany's TR-4

A WEST GERMAN firm has entered the computer field with the production of the Telefunken TR-4. The Konztanz, W. G., firm has delivered the first model to Regnecentralen, the Danish Computing Center in Denmark.

Constructed to encompass the broad field of scientific, technical and industrial calculations, the TR-4 is composed of four main units; calculating, memory, order and in-output. These four units can operate independently of each other and allow simultaneous computations. The distribution register connects the specified parts of the computer with each other.

The TR-4, a binary, parallel computer, has a clock frequency of 2 MHz. Performance requirements are about 2 kw. It has a microprogram control unit with expandable plug-in units for orders, an automatic computation control and transport supervision.

Its numerical system is both binary and decimal. Word length is 48 bits with an additional 4 bits for checking and character recognition. Number representation is afforded through fixed point, binary – 13 decimals in the form $|x| < 1$; floating point, binary $-10^{-2^{12}} < |x| < 10^{+2^{12}}$; fixed point, decimal -11 decimals. It uses 8 signs per word with 6 binary positions for each sign.

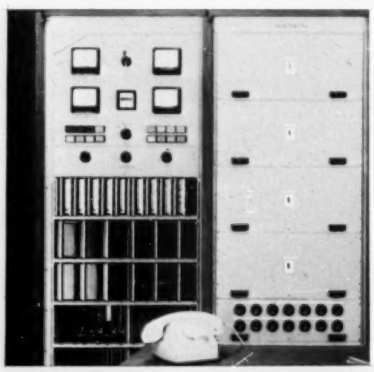
The arithmetic unit is composed of five registers with direct memory connection: multiplicand register, accumulator, multiplicating register, transfer register with internal machine significance and assisting register. The assisting register serves as fast access memory and qualifies the arithmetic unit among others for accumulated multiplications and consequently for the calculation of fractional products. The manufacturer states that ultra high frequency transistors, parallel mode and the high clock frequency are responsible for the computation speed.

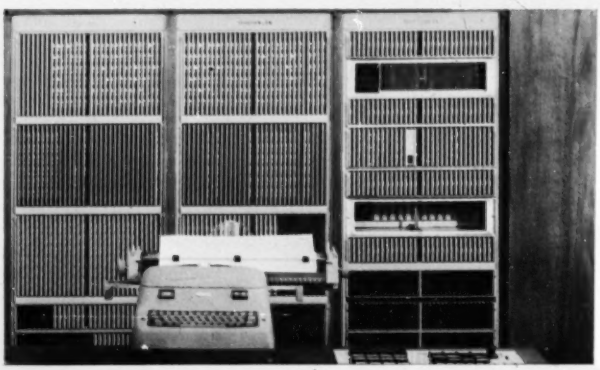
The registers are built of static flip-flops with register elements. Diodes are also used in the construction. Computation speeds, excluding access time, are shown at right.

The memory unit is composed of two ferrites each of 4,096 (2^{12}) words, each of 52 bits. Maximum capacity of the working memory is 7 x 4,096 = 28,672 words. Cycle time is 6 μs. The fixed memory carries information which can be read out, but not altered through the program. The fixed memory contains 2^{10} = 1,024 words for standard programs, as in and out test programs. The fixed memory can be extended to 4,096 words.

The index memory is for the recording of addresses. The word length is accordingly of 16 bits and the capacity is 2^8 = 256 words. The index memory works simultaneously with the aggregate of the working memory. Magnetic tape units serve as large capacity memories as well as in and output.

The magnetic tape units have a speed of 250 cm/sec. and work at 37,500 characters/sec. The ½ inch magnetic tape contains 6 tracks, plus 1 for control and 1 for clock. Spools are of the international type (10.5 diameter) with mi. 750 m. tape lengths. A buffer allowing compatibility with 8 devices is used, with a possible maximum of 8 such buffers, allowing a





The Telefunken TR-4, a binary, parallel computer, has applications in the broad field of scientific, technical and industrial calculations.

TR-4 COMPUTATION SPEEDS

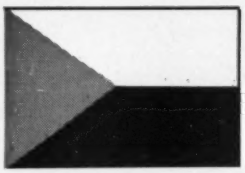
	addition	multiplication	subtraction
Fixed point, binary	5 μs	30 μs	105 μs
Floating point, binary	16 μs	30 μs	90 μs
Fixed point, decimal	10 μs	500 μs	500 μs

total of 64 such devices. This buffer is also used to connect the following devices: punched card devices; paper tape devices; a typewriter; speed printer; and in the future a punch card sorter and paper tape changer.

The punched card devices work in direct connection to the arithmetic unit. Each column is read in two technical words so that the image of the punched card originates in the working memory. The input is checked through the second brush station. When using commercial punched cards, the reading speed will be 42,000 to 48,000 cards per hour and punching speed about 6,000 to 15,000 cards per hour.

The reading speed of the paper tape devices that work best with the unit varies between 500 to 1,000 characters per second, the punching speed between 150 to 300 characters per second.

The arithmetic unit is contained in a cabinet which has a width of 142 inches, a height of 63 inches and a depth of 17¾ inches and the corresponding circuitry is included.



Czechoslovakia's EPOS

THE CZECHOSLOVAK State Statistical Office is preparing a five-year, long-range plan for the development of mechanization and automation of record-keeping. This is the first Czechoslovak plan which provides for record-keeping and computation employing automatic computers. In the view of the fact that Czechoslovakia does not currently have automatic computers and has had no experience with their selection, installation, programming, control, etc., particular attention will be devoted to these matters in the plan preparation so that the finished plan may be fully realistic.

According to the plan, production of the EPOS automatic computer is to begin in Czechoslovakia in 1963. The price of the computer is expected to run in the hundreds of thousands of dollars, depending upon the equipment of the machine.

Since, by the end of the third five-year plan several dozen of these automatic computers are to be produced, it will be necessary to provide future users of these machines with maximum assistance and information in the performance of the EPOS computer even though the plan for production of this machine is only now being prepared.

The State Statistical Office held a conference last year, which was attended by specialists from the development, production, and technical distribution sectors of the automatic computer field, and by representatives from all ministries and enterprises which plan to equip their computation centers with such computers.

In order that the conference might be correctly oriented, the State Statistical Office conducted an extensive campaign to secure possible questions regarding the various phases of the computer program. Over 120 specific inquiries were obtained as a result of this campaign. These inquiries were classified into specific topic groups and passed on to specialists in the appropriate fields of automatization. The lectures given in the course of the conference contained primarily new and unpublished information.

The lecture topics included: "Study and training problems resulting from the installation of the EPOS automatic computers;" "Technical information on the EPOS computers;" Significance of a communications network for efficient utilization of automatic computers;" "Providing training for automatic computer personnel at advanced schools in Prague;" and "Preparation and installation of automatic computers in Czechoslovakia."

Following the lectures, other specialists joined in the discussions. They concentrated their attention upon problems of training personnel to operate the machines, the supply of professional literature, the utilization of analog computers, and long-distance transmission of information.

Great Britain's ELLIOTT LTD.

ASSOCIATED AUTOMATION LTD. of London, England, one of the divisions of the Elliott-Automation Group, deals specifically with automation accessories and peripheral equipment. Included among these products are: paper tape readers; magnetic drum stores; magnetic disc stores; and Compuprinter.

For the purpose of comparing typical European peripheral equipment with similar equipment in the United States, Datamation has prepared the following analysis of a cross section of Elliott products.

paper tape reader

The Elliott paper tape reader operates at any speed up to 1,000 characters per second and reads standard 5-, 6-, 7- and 8-hole punched paper tape. The tape is drawn through a pair of clamping plates and a photo-electric reading station by a capstan and a pinch roller. The pressure between the clamping plates is controlled by an electromagnet. This provides a high speed braking action which stops the tape within a half of a millisecond.

The instrument is complete with lamp, driving motor, electromagnets and optical system. The holes in the tape are sensed by nine OCP71 phototransistors which are illuminated through perspex light guides. The tape stopping is accomplished in 0.5 milliseconds.

magnetic drum stores

Originally designed for use only with the Elliott 402 computer, these magnetic drum stores are now available for use with any make. The information is stored on the magnetic coating of the drums by the phase modu-

Elliott's paper tape reader.

lation method of recording, the same head being used for reading and writing. The speed of the drum is 4,600 rpm and is arranged so that a whole number of words can be stored on one track, giving a circulating store. The access time is approximately 13.0 milliseconds. The capacity of the store is 5,888 words and 32 bits which is recorded on 46 tracks of 128 words.

The 50 reading-writing heads are mounted in groups of ten round the periphery of the drum and are adjustable relative to the oxide coating on the drum by a cone and screw mechanism. The flux gap is set to .0008 inches so that no mechanical wear takes place between the head and the oxide coating. Four heads are used for clock and address tracks and forty-six for information.

The store is complete with drum, heads and leads and a 200 volt 1/20 h.p. dc split field motor.

magnetic disc stores

A storage capactiy of 16,384 words of 32 bits which is recorded on 64 tracks of 256 words is available in this 19¼ inch magnetic disc. The speed of the disc is 2,350 rpm, with an access time of approximately 25 milliseconds.

The digit packing density is about 166 bits per inch and the recording frequency is 333 kc per second. The 80 reading-writing heads are mounted in groups of eight on each side of the disc and are adjustable. The core of the head consists of seven mu-metal laminations .002 inches thick forming a thoroid. The three middle laminations project beyond the outer lamination and are split to form the flux gap. A coil of fifty turns of wire is connected to a length of twin screened cable. The coil and core are potted in Araldite leaving only the projecting laminations exposed. The width of the projecting laminations is about .009 inches and the holders are staggered on the brackets to give a track pitch of .0300 inches.

magnetic film stores

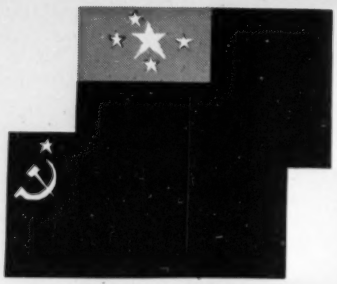
The film store is designed to record and read information on 35 mm magnetic film. The film runs at 30 in. per second past a 9-track recording/reading head. The normal length of a reel of film is 1,000 feet, and takes 6 min. 40 sec. to run from end to end.

The reel motors are servo controlled to maintain constant film tension and microswitches are incorporated to prevent damage to the mechanism should the film break or jam. If these switches are actuated, a reset switch must be operated before normal running can be resumed.

Information can be recorded or read on any combination of the 9 tracks simultaneously, but writing and reading cannot be carried out together. Normal usage is to store information on 3 tracks in one direction and on another 3 tracks in the other direction, the 9th track being used to provide location pulses or block markers and the remaining tracks are used for clock, one for each direction.

compuprinter

The Compuprinter is a single character printer which is electrically driven and can be remotely controlled to print at the rate of 20 characters per second. It was designed to be suitable as a direct output from a computer and from data logging equipment. It is also available as a high speed print out system from telecode perforated paper tape. The basic mechanism is the same for all three applications although a number of minor variations are normally introduced for data logging.



China—USSR Language Translation

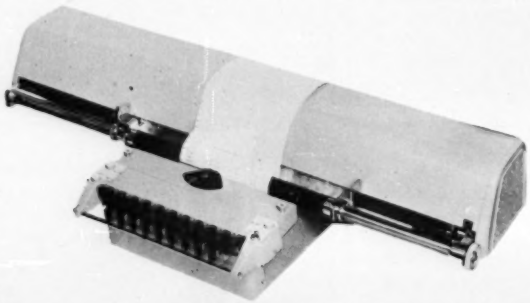
INTENSIVE RESEARCH work has been done in the Soviet Union for the past few years to obtain effective methods for rapid translation with electronic computers of texts from various languages into Russian.

The Russians' progress in this area is evidenced by the fact that a group of researchers within the Academy of Sciences as early as November, 1957 had solved the theoretical problems and created a system for machine translation of Chinese mathematical texts into Russian. Because of the special structure of the Chinese language, the task has been extremely difficult to handle.

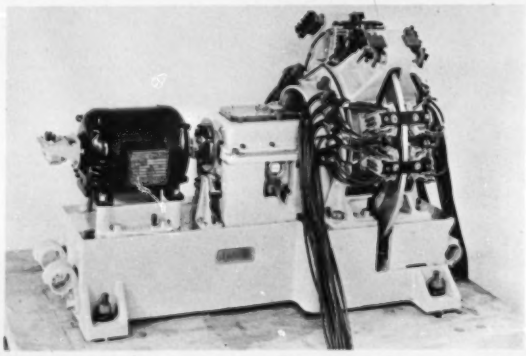
The presentation of the results was given in a report entitled "About machine translation from Chinese into the Russian language." Its author, V. A. Voronin, is a staff member of the Institute for Precision Mechanics and Computational Technology of the USSR Academy of Sciences in Moscow. The original processed report was issued with a print of 300 copies, which despite that apparently small number, nevertheless reflects a rather comparatively large interest among what could be described as a narrow specialty.

We are now able to present a de-

The multi-application Compuprinter, designed by Elliott-Automation Group, can be remotely controlled to print at 20 character per second.



This Elliott magnetic disc stores has a total word capacity of 16,384, of 32 bits which is recorded on 64 tracks of 256 words.



tailed report on this advanced Russian method. The report examines the fundamental principles for the first algorithm variant intended for machine translation of Chinese into Russian, and contains a short description of the most important processing stages for the grammatical analysis of the means of expression of the Chinese language.

The lack of flection endings is causing considerable difficulty. The work to solve the problems was started with the study of practical material. At the same time attempts were made to find a method for analyzing the Chinese sentence structure. Scientific works and articles were used as raw material dealing with physics, mathematics, architecture, and biology, as well as literary works which had been recommended by authors for inclusion in textbooks of Chinese grammars.

The Russian team of researchers came to the conclusion that the thing most adapted to its purpose was to use the so-called mathematical programming text, particularly taking into consideration that this would be able to a large extent to embrace the forms of expression and words that are significant for the Chinese writing language.

The words of the Chinese language have, as a result of the specific grammatical structure of the language, no formal distinctions that would make it possible to define certain words belonging to a special morphological category.

The author of the original report states: "Therefore, the analysis of a single Chinese word entering the translation programming with a certain meaning and with a certain complex of lexicographic differentiation, gives no information whatsoever about the morphological characteristics of the word. With extremely few exceptions, for example certain verb forms, Chinese words lack changeable intrinsic components, which would have corresponded to flection endings in Indo-European languages."

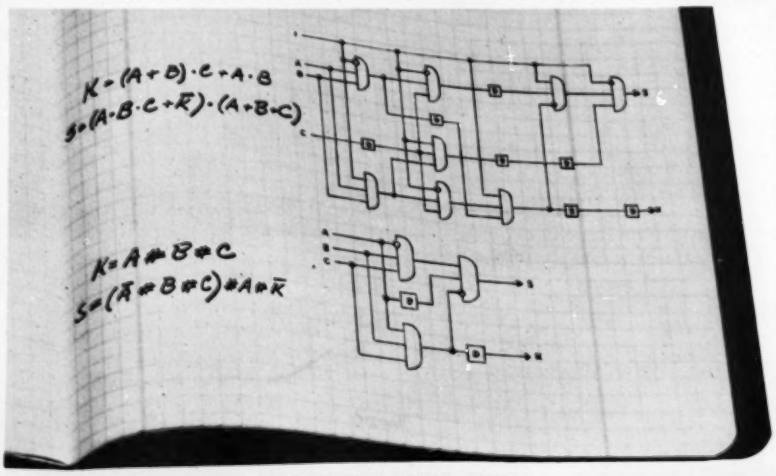
Thus, morphological characteristics of a given Chinese word can be obtained only by analysis of other words; connected with a given word through different types of contexts, for example the so-called "help-words" which play a very important role in the Chinese language.

As for the "help-words," these cannot give very good information about the given words to which they are connected by meaning. To obtain a detailed characteristics description for a given Chinese word, it is necessary to combine the following sources: (1) The lexicographic characteristics of the given word; (2) The grammatical characteristics in the words that are syntactically connected with the given word, and; (3) The analysis of the help-words.

The first and third sources are from the point of view of machine translation the easiest, while the second one creates the greatest difficulty for the programming work as the number of words in this group is unlimitedly great, theoretically speaking. This is the main stumbling block for machine analysis.

For machine translation from Chinese into Russian, a special schedule of grammatical analysis has been developed; 1/punctuation marks, 2/syntactical examination of every sentence, 3/punctuation marks of every sentence into clauses, 4/the numerals, 5/nouns, 6/verbs, 7/adjectives, and 8/alteration in the word order.

The final product has now become a readable and understandable Russian in texts where the Chinese original words had not only been replaced by their Russian equivalents, but they had also obtained the correct Russian flection forms and the Russian word order has been followed in each detail.



The binary adder stage produced in conventional design (top) has been reduced and simplified through Majority Logic Design to the diagram and formula at the bottom. Discovered and formulated in the Remington Rand Univac Mathematics and Logic Research Department, Majority Decision Logic is a new logical algebra, which opens new and interesting possibilities for the reduction in the number of logical elements in computer design.

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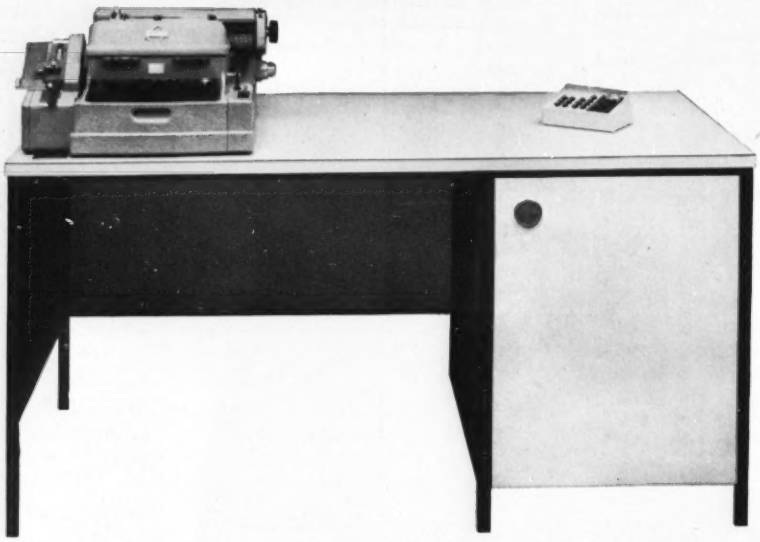

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	RECOMP III	COMPETITIVE COMPUTER
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Input Standard	Mechanical Reader	_____
	10 char/sec	_____
	Typewriter Engineering Keyboard	_____
	Typing Speed	_____
	Full Alphanumeric Input	_____
Input Optional	Capacitance Reader	_____
	600 char/sec (stops within a char)	_____
	Up to any type of four inputs	_____
Arithmetic Speeds—Fixed Point		
Add & subtract	.54 milsec (12 digits)	_____
Multiply	10.8 milsec (12 digits)	_____
Divide	11.3 milsec (12 digits)	_____
Access Time—Main Memory—average	9.0 milsec	_____
High Speed Loops—average	1.7 milsec	_____
Arithmetic Speeds—Floating Point		
Add & subtract	.81 milsec (12 digits)	_____
Multiply	8.6 milsec (12 digits)	_____
Divide	8.9 milsec (12 digits)	_____

	RECOMP III	COMPETITIVE COMPUTER
Memory	Disk—Non-volatile	_____
	Capacity 4096 words	_____
	Word size 40 bits & sign	_____
	12 decimal digits	_____
	Command size—2 commands per word	_____
	Instruction capacity 8192 instructions	_____
Programming	Machine language (fixed point) very simple and versatile	_____
	Machine language (floating point) very simple and versatile	_____
Outputs—Standard	Typewriter (alphanumeric engineering keyboard)	_____
	10 char/sec (printing speed)	_____
	Paper Tape Punch	_____
	10 char/sec (punching speed)	_____
Outputs—Optional	Facitape High Speed Punch	_____
	150 char/sec	_____
	Up to four outputs	_____
Characteristics	250 pounds (computer)	_____
	Solid State	_____
	Desk size	_____
Power Requirements	3.5 amps any wall outlet 115 v ac	_____
Heat	No cooling needed	_____

If your computer, or a competitive computer, doesn't measure up to Recomp III, this coupon can save you time and money.

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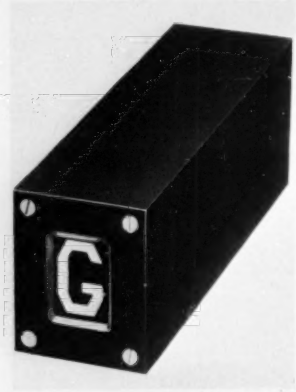
CIRCLE 22 ON READER CARD

alpha-numeric display module

Alpha-numeric display module type IL-2000 can display 64 individual characters when operated from a 6 bit binary input, or 16 characters when

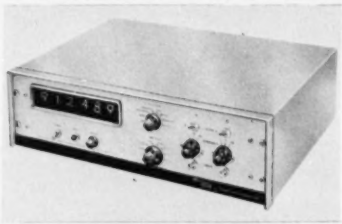


operated from a 4 bit binary input. The display will change from one character to any other within a maximum time of 50 milliseconds. The module will display and hold any individual character, without any drain on the command input circuit, through a locking device incorporated in the display mechanism. The display is internally lighted and each character, which measures 0.5 in. in height and 0.3125 in. in width, may read with clarity from a distance of 30 ft. and within an included viewing angle of 90%. The design of this instrument is such that any desired combination of letters, numbers or symbols is available. SERVOMECHANISMS INC., 200 N. Aviation Blvd., El Segundo, Calif. For information:

CIRCLE 200 ON READER CARD

frequency-time digimeter

A solid state megacycle frequency-time digimeter, model 851, has two identical 1-2-4-8 BCD counting trains, combined with two identical input amplifier channels and a switching unit, comprise the basic building blocks of the counting system. Logical interconnections effected by dc level control provide more than the usual functions that are to be found in this type of equipment. A gated time base counter divider introduces the facility for burst or damped train measurements and also extends the accuracy with which period measurements may be made by the continuous decimal



selection of period groups. ELECTRONIC COUNTERS INC., 155 Eileen Way, Syosset, L. I., N. Y. For information:

CIRCLE 201 ON READER CARD

magnetic core memories

Magnetic core memories, both destructive and non-destructive meet all appropriate military specifications. These core memories have been used in several military computers. Random access, linear select techniques, coupled with advanced electronic circuitry, provide two microsecond read-write cycles. Current variations of ± 10% and temperature Delta T of ±30° C without external compensation are part of the core memory products. LITTON SYSTEMS INC., Woodland Hills, Calif. For information:

CIRCLE 202 ON READER CARD

program unit

A new small tape program unit is capable of automatically controlling digital tape machines to run in both forward and reverse directions. Use of this

brief-case size programmer provides for off-line control of digital tape machines to aid in servicing and adjustment. Forward and reverse run times

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Here's a different kind of invitation . . .

Conferences are wonderful—but they *can* get hectic. Talk, talk, talk. Walk, walk, walk. Sell, sell, sell. So here's our suggestion: relax a minute and come in and see us. Not "selling" anything. And the only thing we'd like to talk about is *your* career and *your* future . . . and how you can make the most of it.

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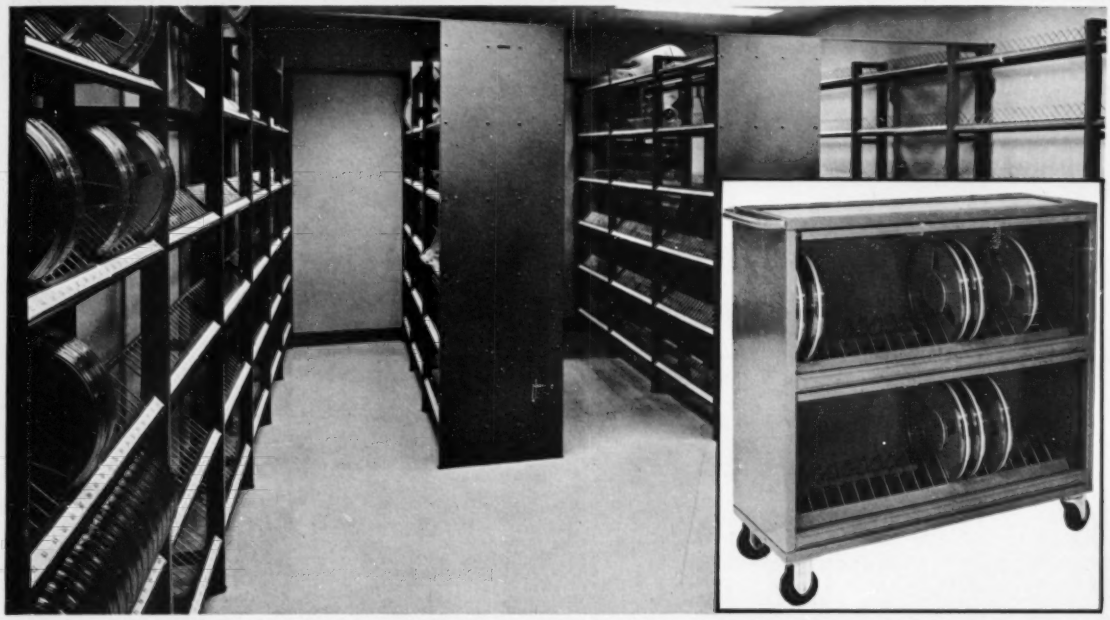
CIRCLE 87 ON READER CARD

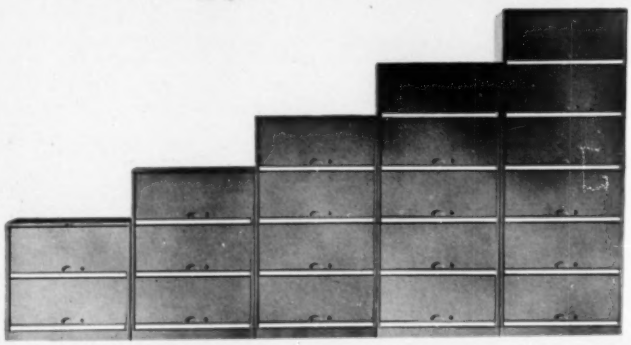
SYSTEMS *Magnetic Tape* STORAGE *Speaks for Itself*



COMPANIES ALL OVER THE COUNTRY ARE NOT JUST TURNING TO SYSTEMS MAGNETIC TAPE STORAGE AND HANDLING UNITS. . . . THEY HAVE BEEN USING THEM REGULARLY FOR YEARS. . . .

What is the big story behind this success?

Systems EDP Equipment is designed to fit your installation rather than forcing you to design your system around existing equipment.



In short, consult your Systems Representative before you make your move into Magnetic Tape Storage and Handling Units. Experienced lay-out service available to you, free of charge.

Write today for full brochure and details about SYSTEMS COMPLETE MAGNETIC TAPE STORAGE UNITS. Systems, with sixteen years' experience in the Magnetic Tape Field.

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Choose now from the widest selection of Specialized Reel Equipment available anywhere:

- LIBRARY UNITS
- MODULAR CABINETS
- SLIDING DOOR CABINETS
- TAPE REEL TRUCKS
- TAPE REDDY RACKS FOR TAPE DRIVES
- REEL CARRY CASES, FOR REEL SHIPMENT
- REEL FILER RACKS, FOR DESK TOP STORAGE
- CONSOLE DESKS AND SPECIAL ADAPTATIONS

And look at these Storage Features:

- Open, completely dust-free construction
- Tape Reels float in controlled air.
- Maximum Storage in Minimum Space.
- Individual sections, with disappearing doors.
- Flexibiilty for the future, for expansion or for future change.
- Complete line of carts to pass through the narrowest aisles.
- Units also available with shelves.
- Individually locked, with OUTSIDE labelling.
- Desk height units, and Counter Height Units.

floating floors

SITE ENVIRONMENTAL PACKAGE

FOR RCA 301 SERIES

Based upon the demands of the Data Processing Industry, Floating Floors Inc. is announcing the first step in the Complete Package Concept.

Major problems encountered in the Package Concept have been the air conditioning equipment and electrical panel. To answer these problems, our Research and Development Department has designed and developed a complete mechanical equipment room within a Package. The size of the unit is 33" wide by 72" long by 72" high, mounted on 8" casters and weighing only 1,200 lbs.

The Package Unit offers the following specifications for a basic 600 sq. ft Site:

1.00 **AIR CONDITIONING**

- 1.01 Cooling capacity of 64,000 BTU net (6 HP) at 75°F city water or 54,000 BTU at 85°F cooling tower water.
- 1.02 Two separate 3 HP compressors circuited so that if one fails, the other compressor will operate as a standby. (When equipment is used with a pressurized floor plenum design).
- 1.03 One electrostatic filter rated at 70% (N. B. S.)
- 1.04 One visible chart recorder giving temperature and humidity records, which can be either a part of the Package or located where desired.
- 1.05 Air capacity of 2,750 CFM.
- 1.06 Sound and thermal insulation.
- 1.07 One condenser water hook up for heat release and humidity circuit. (Service line from source and connection by others).
- 1.08 One drain connector for relief of condensate. (Line from unit to drain outlet and connection by others).
- 1.09 Built in controls to meet seasonal conditions or room requirements to operate the compressors as required.
- 1.10 Humidification and temperature controls.
- 1.11 Humidifying capacity of 20 lbs. of water per hour.
- 1.12 Adjustable air outlet converter located on bottom side of unit to allow floor plenum use.
- 1.13 Electrical connection on side of unit to activate complete circuit.

2.00 **ELECTRICAL PANEL**

- 2.01 Main breaker for 1401 incorporated in the Package Unit. (Power line from main source to main breaker by others).
- 2.02 Extra breakers mounted on electrical panel if required.

3.00 **FLOATING FLOOR**

- 3.01 600 sq. ft. of Floating Floor. (Marbleized vinyl tile 18" x 18" x ⅛" with plastic lip edge).
- 3.02 One ramp.
- 3.03 Fifteen cable cutouts.
- 3.04 20 lineal feet of air diffusers with dampers.

The above Package will handle approximately 600 sq. ft. based upon conditions, site location and condenser water temperature. Multiple units of the Package can be expanded as required.

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CIRCLE 25 ON READER CARD

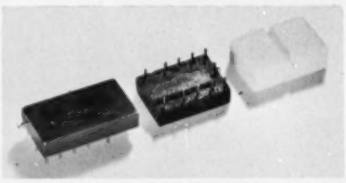
NEW PRODUCTS . . .

and stop times are individually adjustable in the range from 2.5 milliseconds to 1 second by means of selector switches. The unit generates forward and reverse outputs capable of driving the actuator control circuits of the tape machine. The unit is completely self-contained in an instrument case 4 x 7 x 8 in. BINARY ELECTRONICS CO., Bldg. "E", 824 E. Walnut Ave., Fullerton, Calif. For information:

CIRCLE 203 ON READER CARD

logic circuits

Nine standard Weld-Pak logic circuits for direct substitution in transistorized computer circuits have been introduced. A typical plug-in unit incorporates 17 diodes, capacitors and resistors plus two transistors in packages

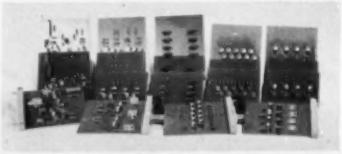


smaller than one-third cubic in. All packages employ PNP transistors and use -10V and 110V supplies with suitable clamp supply when necessary. RAYTHEON COMPANY, 55 Chapel St., Newton, Mass. For information:

CIRCLE 204 ON READER CARD

modules

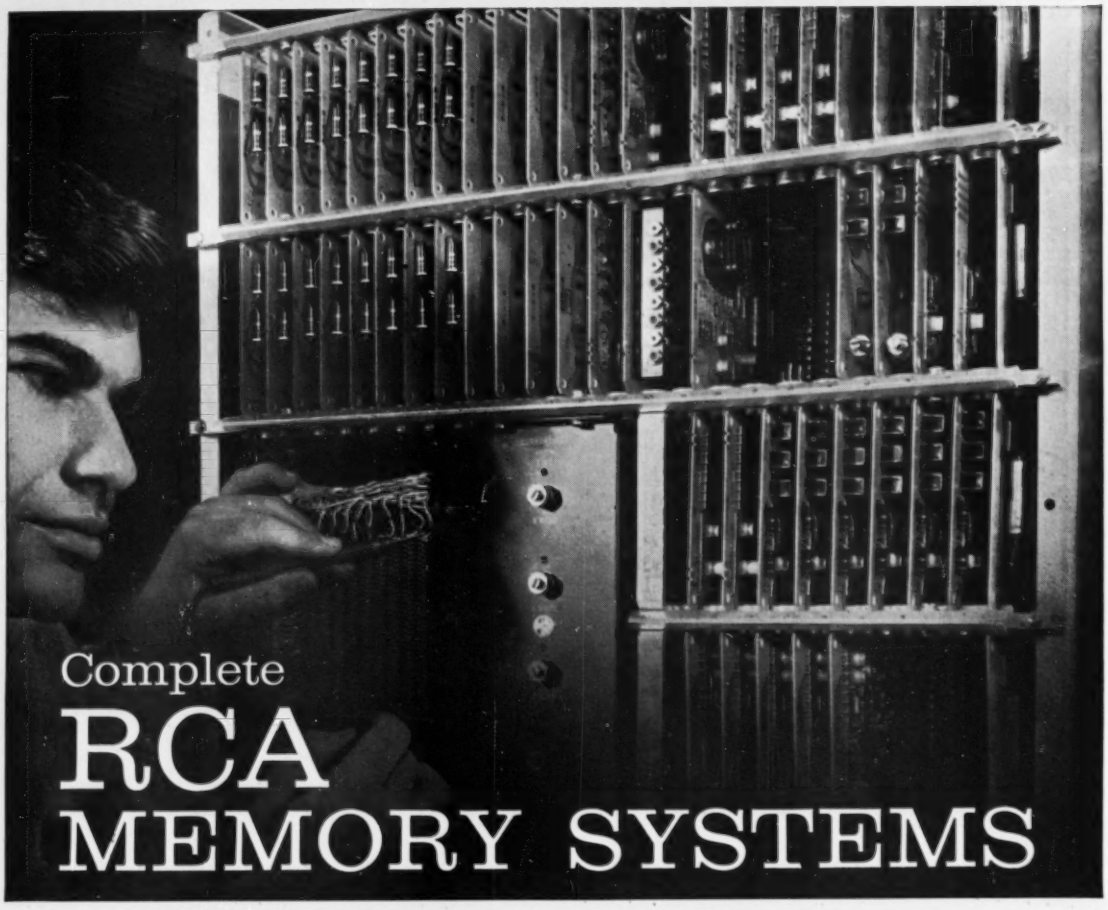
A new series of 13 modules for data processing applications has been announced in technical note No. 68. The new series includes: dual flip-flop, and-or inverter, gate circuit, analog switch, one shot package, power driver-lamp, dual power driver, pulse



generator, analog voltage comparator, octal-hexadecimal decoder, read package, decimal decoder and record package. For information send $2 to the NATIONAL BUREAU OF STANDARDS, Office of Technical Services, U.S. Dept. of Commerce, Washington 25, D.C.

analog memory

A new analog memory provides shift capability for transferring remembered numbers between different computing channels. Incidental capabilities



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with specified extra wide safety margins

Standard or custom systems, incorporating RCA ferrite and semiconductor devices, are designed, built, and tested by memory-circuit specialists—at RCA's newly expanded memory products operation in Needham, Mass.

Here is the new answer to memory-system design and production, offering new latitude to the computer engineer, new solutions to your system production problems—complete RCA Memory Systems. Designed and produced by RCA from ferrite cores to entire packaged systems, these precision units are pre-tested to broad operating limits and are delivered ready for immediate use in computer designs.

Here are some of the outstanding features of complete RCA Memory Systems:

- **Specified Wider Margins of Operations** ... Up to 8 percent...to cope with broad variations in power levels.
- **Custom Design Service**...RCA's engineering staff will custom-design a memory system to your specifications.
- **Superior Reliability**...Components and circuits proved by the long, dependable service of over 100 systems now in use.
- **Complete Information Retention**...even in case of full power loss.
- **Wide Temperature Range**...0°C to 50°C.

For Systems Engineering Service—Call your RCA Office. *For technical information* write RCA Semiconductor and Materials Division, Commercial Engineering, Section D-109-NN, Somerville, N. J.

RECENT RCA MEMORY SYSTEM SHIPMENT	
Capacity	4096 words, 18 bits per word.
Speed	Complete Read-Write cycle time of 5 μsec.
Modes of Operation	Read-Regenerate/Read-Modify/Write-Only.
Reliability	Acceptance tests made with all power supply voltages varied both plus and minus 5 percent from their nominal values while the system is being temperature cycled.
STANDARD RCA MEMORY SYSTEMS	
Capacity	512 to 4096 words; 6 to 32 bits per word.
Speed	Complete Read-Write cycles times 5 to 12 μsec.
Modes of Operation	Read-Regenerate/Read-Modify/Write-Only.
Reliability	Acceptance tests made with all power supply voltages varied both plus and minus 8 percent from their nominal values while the system is being temperature cycled.

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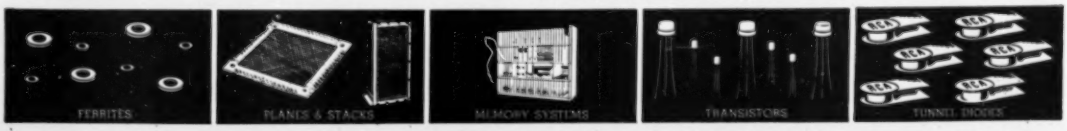
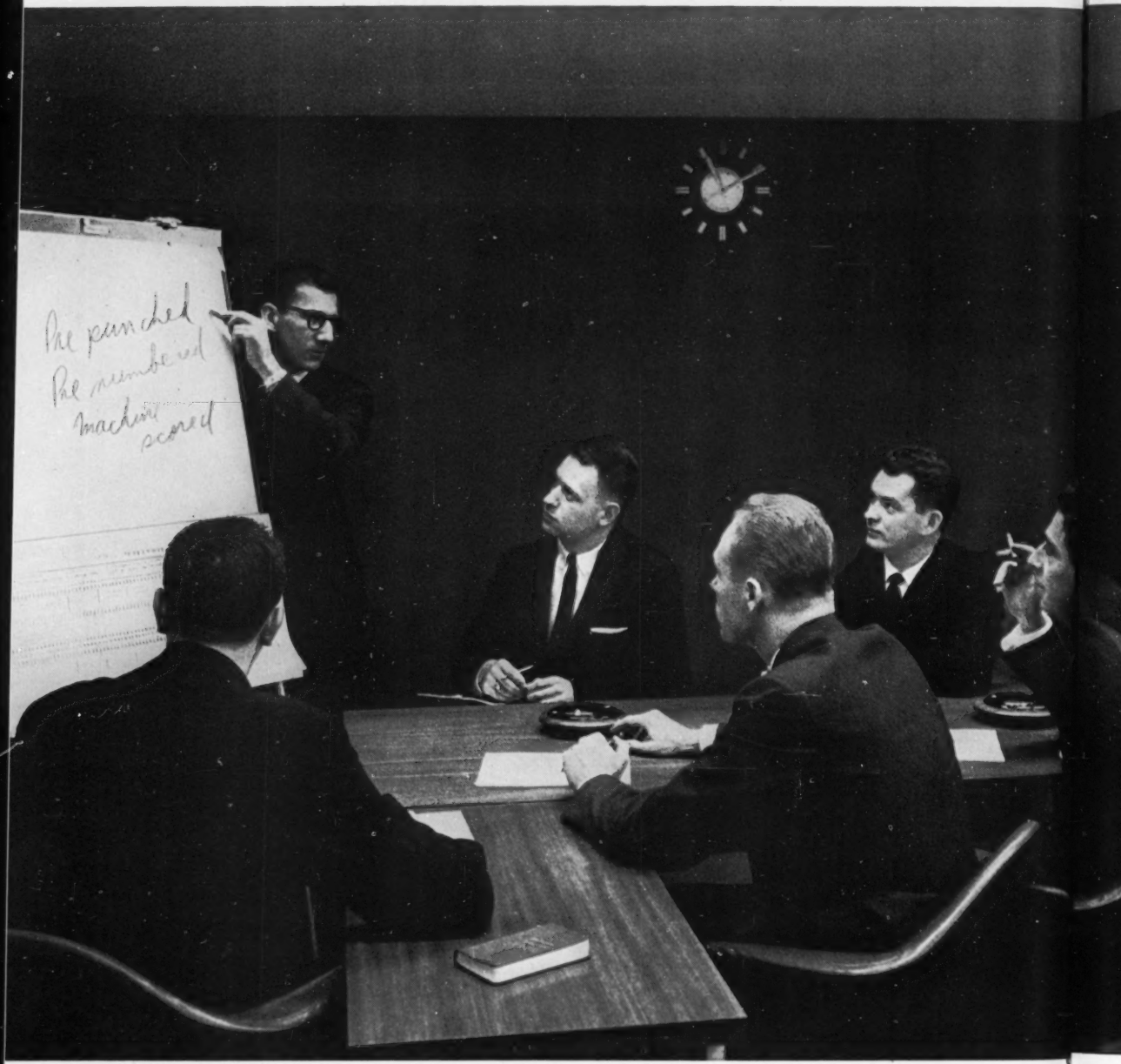
RADIO CORPORATION OF AMERICA

RCA SEMICONDUCTOR & MATERIALS DIVISION FIELD OFFICES... **East:** Newark, N. J., 744 Broad St., HU 5-3900 • Syracuse 3, N. Y., 731 James St., Room 402, GR 4-5591 • **NORTHEAST:** Needham Heights 94, Mass., 64 "A" St., HI 4-7200 • **EAST CENTRAL:** Detroit 2, Mich., 714 New Center Bldg., TR 5-5600 • **CENTRAL:** Chicago, Ill., Suite 1154, Merchandise Mart Plaza, WH 4-2900 • Minneapolis, Minn., 5805 Excelsior Blvd. • **WEST:** Los Angeles, Calif., 6355 E. Washington Blvd., RA 3-8361 • Burlingame, Calif., 1838 El Camino Real, OX 7-1620 • **SOUTH:** Orlando, Fla., 1520 Edgewater Drive, Suite 1, GA 4-4768 • **SOUTHWEST:** Dallas 7, Texas, 7905 Empire Freeway, FL 7-8167 • **GOV'T.:** Dayton, Ohio, 224 N. Wilkinson St., BA 6-2366 • Washington, D.C., 1725 "K" Street, N.W., FE 7-8500.



CIRCLE 26 ON READER CARD

How this new team of IBM Supplies S



IBM SUPPLIES SPECIALIST—uniquely trained to assist you in solving supplies problems promptly, efficiently and to your best advantage.

Specialists can help you

When it comes to cards, magnetic tapes or control panels, the IBM supplies specialists know—as few men do—just how to meet your needs. IBM supplies specialists are true experts...qualified by intensive training in IBM schools, plants, and design centers...qualified by extensive field experience.

Equally important, they represent a company that is unsurpassed for:

PROMPT SERVICE—IBM offers you same-day delivery on control panels and magnetic tapes, to meet emergency needs. In addition, through its nation-wide manufacturing and warehousing facilities, IBM can service *promptly* the card needs of any customer in America.

TECHNICAL ASSISTANCE—Through its network of Card Design Centers, IBM can assist you in developing card designs that will improve card handling techniques, reduce card consumption, and contribute to the economy of your data processing operations. As for control panels, your IBM specialist can help you profit from the ideas and experiences of others who have solved problems similar to your own.

PRODUCT QUALITY—IBM supplies are made to precise specifications which have been developed over more than 40 years of research, testing and performance analysis.

CUSTOMER EDUCATION—Through IBM's Customer Education Centers as well as through plant tours, supplies seminars and informative literature, IBM offers you an unsurpassed opportunity to achieve competence in the use and care of IBM cards, tapes and panels.

PRODUCT RESEARCH—To assure you the best supplies products possible, hundreds of IBM engineers and technicians work full time to develop new, improved products and techniques.

The next time you are in the market for punched cards, magnetic tapes, or control panels, call your IBM office. Talk to the IBM supplies specialist—an expert backed by experts—a man whose main job is to improve the return on your data processing investment.

IBM® DATA PROCESSING

CIRCLE 27 ON READER CARD

DESIGN ASSISTANCE—you can profit by the ideas and experience of others who have successfully solved problems similar to yours.

IMMEDIATE DELIVERY—control panels delivered "off-the-shelf" to meet your emergency data processing needs.

LONGER TAPE LIFE—assured by the unique IBM quality control program for new magnetic tape, plus an exclusive retest service which increases the life of your present tape by over 50%.

floating floors

SITE ENVIRONMENTAL PACKAGE

FOR IBM 1401 THROUGH 1410 SERIES

Based upon the demands of the Data Processing Industry, Floating Floors Inc. is announcing the first step in the Complete Package Concept.

Major problems encountered in the Package Concept have been the air conditioning equipment and electrical panel. To answer these problems, our Research and Development Department has designed and developed a complete mechanical equipment room within a Package. The size of the unit is 33" wide by 72" long by 72" high, mounted on 8" casters and weighing only 1,200 lbs.

The Package Unit offers the following specifications for a basic 600 sq. ft Site:

1.00 **AIR CONDITIONING**

- 1.01 Cooling capacity of 64,000 BTU net (6 HP) at 75°F city water or 54,000 BTU at 85°F cooling tower water.
- 1.02 Two separate 3 HP compressors circuited so that if one fails, the other compressor will operate as a standby. (When equipment is used with a pressurized floor plenum design).
- 1.03 One electrostatic filter rated at 70% (N. B. S.)
- 1.04 One visible chart recorder giving temperature and humidity records, which can be either a part of the Package or located where desired.
- 1.05 Air capacity of 2,750 CFM.
- 1.06 Sound and thermal insulation.
- 1.07 One condenser water hook up for heat release and humidity circuit. (Service line from source and connection by others).
- 1.08 One drain connector for relief of condensate. (Line from unit to drain outlet and connection by others).
- 1.09 Built in controls to meet seasonal conditions or room requirements to operate the compressors as required.
- 1.10 Humidification and temperature controls.
- 1.11 Humidifying capacity of 20 lbs. of water per hour.
- 1.12 Adjustable air outlet converter located on bottom side of unit to allow floor plenum use.
- 1.13 Electrical connection on side of unit to activate complete circuit.

2.00 **ELECTRICAL PANEL**

- 2.01 Main breaker for 1401 incorporated in the Package Unit. (Power line from main source to main breaker by others).
- 2.02 Extra breakers mounted on electrical panel if required.

3.00 **FLOATING FLOOR**

- 3.01 600 sq. ft. of Floating Floor. (Marbleized vinyl tile 18" x 18" x ⅛" with plastic lip edge).
- 3.02 One ramp.
- 3.03 Fifteen cable cutouts.
- 3.04 20 lineal feet of air diffusers with dampers.

The above Package will handle approximately 600 sq. ft. based upon conditions, site location and condenser water temperature. Multiple units of the Package can be expanded as required.

floating floors TWX number is NY 1-3618

floating floors inc

22 EAST 42ND STREET • NEW YORK CITY 17 • YUKON 6-9050

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CIRCLE 28 ON READER CARD

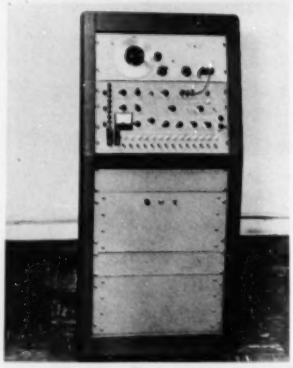
NEW PRODUCTS . . .

of each channel include digital to analog conversion at rates up to 100 kc/sec., and analog to digital conversion at rates up to 6 kc/sec. Several DAM channels used in the analog to digital mode also serve as multiplexers with a maximum multiplexed word rate of the number of channels used times 6 kc/sec. STONY BROOK LABORATORIES, INC., 55 State Rd., Princeton, N. J. For information:

CIRCLE 206 ON READER CARD

magnetic drum check-out

Model MD-100 magnetic drum check-out system offers clock recording, clock smoothing, origin and word track recording, and test pattern recording. A clock track may be recorded circumferentially around the drum with a preselected number of bits, up to 16,883. Closure on this timing track may be made better than 50 milliseconds. The

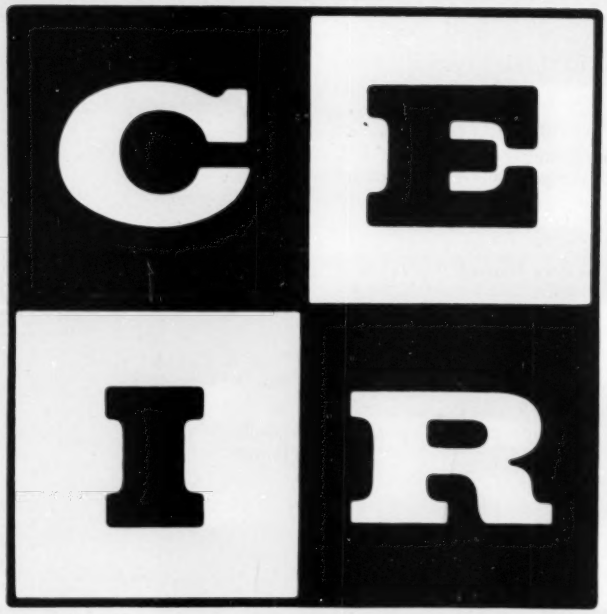


system is capable of recording in either the non-return-to-zero or in the Manchester method. The record amplifier contained in the system is extremely flexible in both the applied voltage and the available drive current. Peak currents of up to 200 milliamperes per leg may be applied with the record voltage from -5 volts to -30 volts. FMA, INC., 142 Nevada St., El Segundo, Calif. For information.

CIRCLE 207 ON READER CARD

tape readers

Two new perforated tape readers for automatic programming employing 8-level standard perforated tape without special punching have been designated the type TP 401 and TP 402. They read 80 bits of information at 6 tests per second and will locate a test program rapidly at 12 inches per second. The tape is advanced one frame at a time on a command signal which is a simple SPST switch closure. The 401 has a verifier panel which shows a full



C-E-I-R CONTINUES TO GROW! AT THE RATE OF 65% A YEAR

--FOR TWO REASONS OF PARTICULAR INTEREST TO YOU

The main reason is that we offer so many services—no one else has them all. Our men and our machines cover a wide range, and our centers are located in strategic regions of the country. There is no other organization into which you can carry a problem and get such immediate attention and such speedy arrangements for machine time.

The other reason is economics. Our clients have found that they get swift service at rates usually considerably lower than elsewhere.

C-E-I-R is a team of more than 350 mathematicians, economists, statisticians programmers, technical specialists and supporting personnel. We operate IBM 7090 computers in Washington, D. C., New York, Boston and London; in addition, we have computer service centers in Los Angeles, Palo Alto, Houston and Hartford. We will install the first private STRETCH computer at our Los Angeles facility in the fall of next year. We invite you to check the pros and cons of a flexible arrangement with C-E-I-R. Just phone (collect, of course) or write the nearest office.

TECHNICAL PERSONNEL!—We have opportunities for creative persons at all of our centers. Inquire of our Personnel Director, C-E-I-R Headquarters.

C-E-I-R INC

Headquarters: 1200 Jefferson Davis Highway, Arlington 2, Virginia

C-E-I-R centers serving the nation:

Arlington, Virginia, 1200 Jefferson Davis Hwy.
New York City, New York, 270 Park Avenue
Los Angeles, California, 11753 Wilshire Blvd.
Houston, Texas, 6422 Fannin Street
London, England, 84 Kingsway, W. C. 2
Palo Alto, California, 501 Webster Street
Boston, Massachusetts, 330 Stuart Street

CIRCLE 29 ON READER CARD

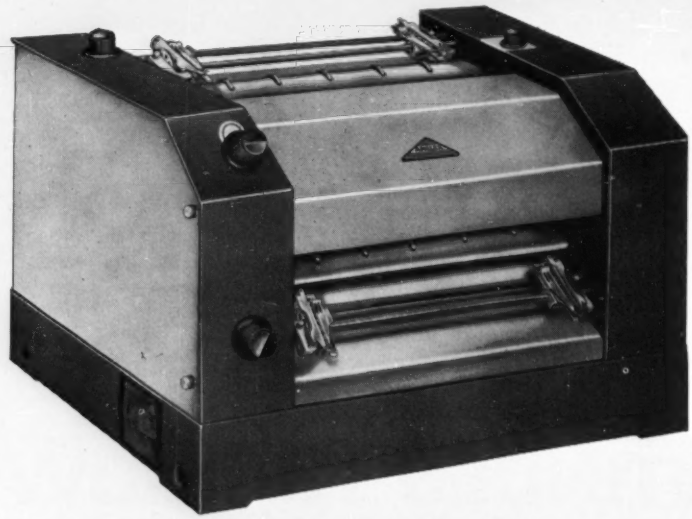
New

ANELEX®

Series 4 High Speed Printers

COMPLETELY REDESIGNED TO SUIT YOUR DEMANDS

If you are concerned with data processing . . . as a systems designer or builder or user . . . you probably helped us redesign these High Speed Printers. We surveyed the market; this is what you told us you want.



SIMPLIFIED ENGINEERING — for lower cost and increased reliability with all the time-tested features of Anelex Printers.

SIMPLIFIED CONTROLS — Anelex Printers are now easier to operate than almost any other office machine.

VERSATILITY —

1 Series 4-1000-SD, prints 1000 or more consecutive lines per minute alphanumeric characters; 2000 lines numeric.
2 Series 4-500-DD, prints 500 or more consecutive lines per minute of alphanumeric characters; 1000 lines numeric. This series provides very substantial cost reduction.
3 Line length, 120 columns; greater or lesser number of columns available.
4 Up to 66 characters per column, Series 4-1000-SD.
5 Print on single or multiple carbons, pressure sensitive papers, heat transfer type papers, card stock and almost every type of continuous pre-printed form from 4" to 19" wide.
6 Print "on line" from data processing systems or "off line" from magnetic tape.

QUALITY PRINTING — perfectly aligned printing and fully formed characters on the original and all carbons.

RELIABILITY — downtime reduced to an insignificant fraction of productive time even under tremendous work loads.

See Anelex Printers and Printer Systems In Booth No. 93-4 Western Joint Computer Conference, May 9 through 11.

ANELEX

ANELEX CORPORATION

155 CAUSEWAY ST., BOSTON 14, MASS.

CIRCLE 30 ON READER CARD

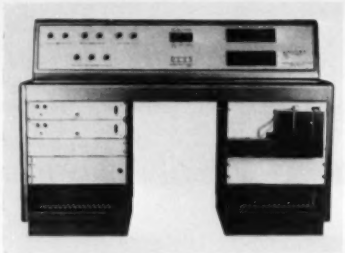
NEW PRODUCTS . . .

frame hole pattern on the front of the unit. The 402 is an identical unit except without verifier panel. ELECTRONIC ENGINEERING COMPANY, 1601 E. Chestnut Ave., Santa Ana, Calif. For information:

CIRCLE 208 ON READER CARD

data acquisition & recording system

A new automatic digital data acquisition and recording system for digital values at rates of up to ten four-character points per second has been developed. Specifically designed for evaluation of mine detection apparatus, the new system measures analog signals generated by the mine detection



apparatus, converts these signals to binary coded decimal form, converts binary decimal to teletype code, and provides digital record of five level punched paper tape. The tape is suitable for teletype printout or may be converted to punched card form for high speed computer analysis. MONITOR SYSTEMS, INC., Fort Washington Industrial Park, Fort Washington, Penna. For information:

CIRCLE 209 ON READER CARD

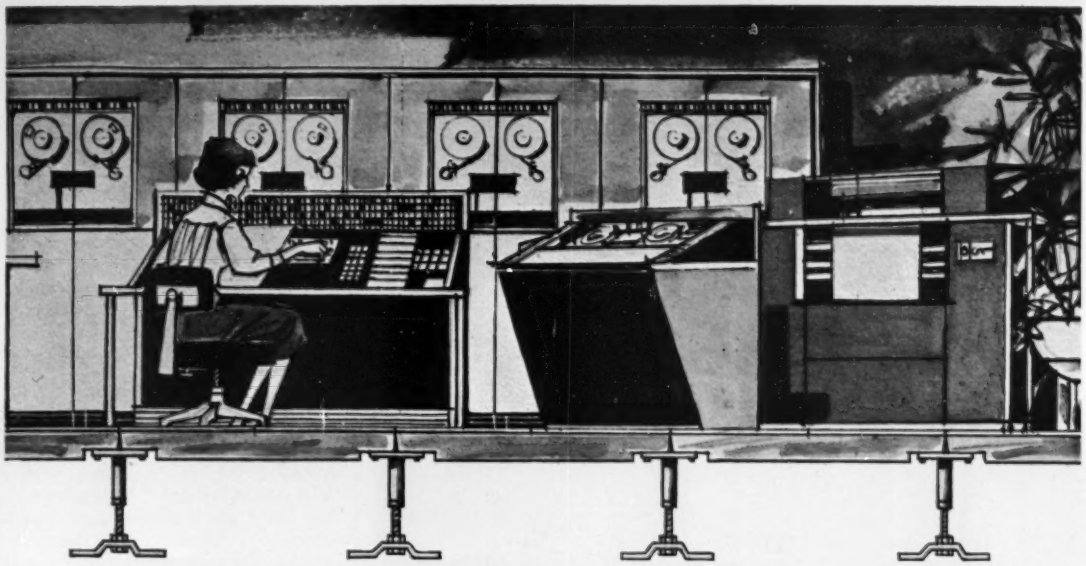
digital-to-analog converters

A new line of solid state digital-to-analog converters for military and industrial applications in hybrid digital-analog systems is being offered with a 300 KPPS maximum clock rate. The unit is self-contained including storage, power supply, reference transformer, and forced air cooling. AC and DC models up to and including ten bits and a sign bit are also available. The modular design of these units allow economical modifications to particular requirements. DYNAMIC SYSTEM ELECTRONICS CORP., 2001 N. Scottsdale Rd., Scottsdale, Ariz. For information:

CIRCLE 210 ON READER CARD

digital modules

A new series of plug-in high speed digital modules, the series S, operate in the frequency range from dc to one megacycle. High package density and moderate power requirements are two



Greater plan flexibility and greater under-floor space with

LUPTON ALUMINUM RAISED FLOORING SYSTEM

For Electronic Data Processing Rooms

Designed specifically for computer installations, LUPTON Aluminum Raised Flooring provides a stable, attractive floor with plenty of space underneath for cables, ducts and wiring. It offers you a number of important advantages.

Flexibility and accuracy. LUPTON aluminum raised flooring consists of strong, lightweight aluminum floor panels supported by adjustable steel pedestals. These panels . . . accurately made to close tolerances . . . are 100% interchangeable. You can make changes and additions to your plan and achieve tight fit. You also have complete re-use of your standard components with new materials.

More under-floor space. The 2′ x 2′ modular construction of LUPTON panels . . . conforming to EDPM modules . . . results in fewer pedestals to obstruct under-floor areas. In addition, panels are only 1⅜″ deep, permitting a greater cubic area of under-floor space.

Strength with light weight. LUPTON panels withstand 300 lbs./sq. ft. of uniform load, or 1000 lbs./panel of concentrated load. Although the total weight of the floor is less than 6 lbs./sq. ft., it is vibration-free and feels firm and stable underfoot.

Vinyl tile flooring. You can select an attractive vinyl tile floor covering in any color scheme or pattern desired. The exact uniformity of LUPTON panels permits tight tile-to-tile fit at every joint . . . eliminates the need for any lip or edging around the perimeter.

LUPTON offers you its aluminum raised flooring system on either a materials delivered basis, or as a complete installation. Either way, LUPTON furnishes an experienced field supervisor during installation.

Write today for a comprehensive brochure on LUPTON's distinctively improved raised flooring system.

Total access to under-floor space. With the LUPTON aluminum raised flooring system, you can efficiently "lay in" cables rather than "thread" them. Locate cable or duct entry panels anywhere on the floor area. Make cutouts on the site.

LUPTON®

ARCHITECTURAL ALUMINUM

MICHAEL FLYNN MANUFACTURING COMPANY

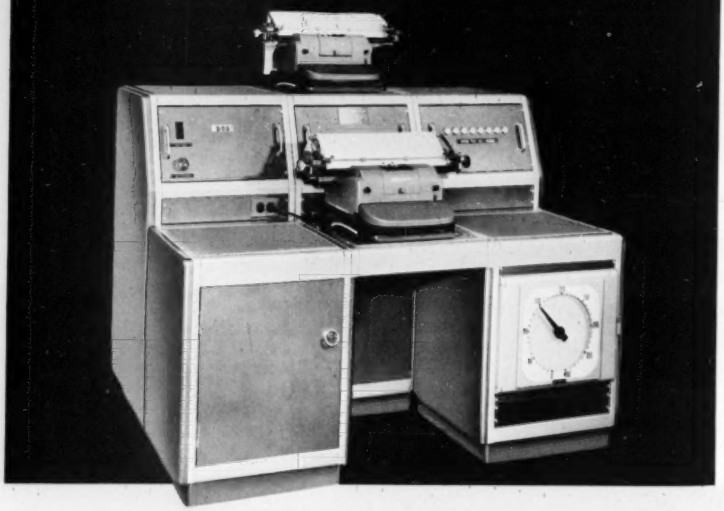
Main Office and Plant: 700 E. Godfrey Avenue, Philadelphia 24, Pennsylvania
West Coast Office and Plant: 18111 E. Railroad Street, City of Industry, Calif.

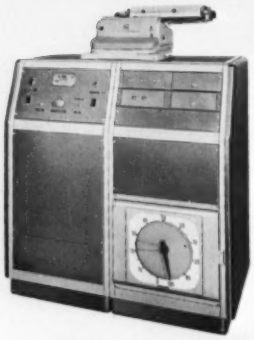
SALES OFFICES

New York 17, N.Y., 51 E. 42nd St. • Stockton, Calif., 1441 W. Fremont St. • LaGrange, Ill., 633 S. LaGrange Road • Dallas 19, Texas, 4232 Herschel St. • Cincinnati 8, Ohio, 3434 Michigan St. • Cleveland 15, Ohio, Hanna Bldg.

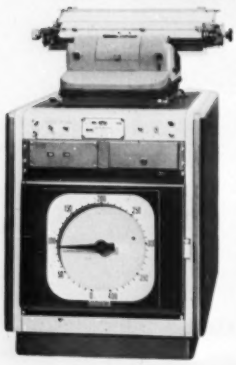
CIRCLE 31 ON READER CARD

Read-out the unexcelled flexibility in data processing equipment housing with





EMCOR® STANDARD CABINETS



DATA-MASTER automatic data loggers designed and manufactured by The DATA-MASTER Corporation, Glen Cove, New York, are recognized for their versatility; portability and reliability features. The units housed in EMCOR Standard Cabinets will log any variable that can be recorded or indicated. Enclosure flexibility for data processing equipment is offered by a selection of over 600 basic frames and the thousands of component parts of the EMCOR Modular Enclosure System. Only EMCOR, the originator of this system, provides the ultimate in design, flexibility, compatibility, rugged structural capabilities, beauty and quality controlled craftsmanship in the fabrication of metal enclosures. Your local EMCOR Sales Engineering Representative can help you read out the answer to your enclosure problem. Get full details.

WRITE TODAY FOR OUR CONDENSED CATALOG 106.

QUALITY EMCOR PRODUCTS — INGERSOLL B-W PRODUCTS — BORG-WARNER

Originators of the Modular Enclosure System

INGERSOLL PRODUCTS

Division of Borg-Warner Corporation

630 CONGDON • DEPT. 1248 • ELGIN, ILLINOIS

CIRCLE 32 ON READER CARD

NEW PRODUCTS . . .

features of the line. Designed for use in digital systems, glass epoxy cards, etched circuits, anodized aluminum frames with package identification and ultra-reliable 34 pin connectors are some of the major features. Signal levels of ground and −6 volts are standard, and 2 volt noise margins are assured to allow reliable application in large systems. The complete S-Pac series will consist of approximately 25 different package types plus complementary hardware. For information write COMPUTER CONTROL COMPANY, INC., 983 Concord St., Framingham, Mass., or use card.

CIRCLE 211 ON READER CARD

delay lines

The compact series 8710 of 1 in. delay lines are continuously variable, distributed constant units that afford precise selection of extremely short time intervals. Delay times of one microsecond to 0.1 microsecond are provided, with rise times less than 10%

of total delay time. All models have an ambient temperature range of -55°C to -80°C, and life expectance of one million or more shaft revolutions. HELIPOT TECHNICAL INFORMATION SERVICE, 2500 Harbor Blvd., Fullerton, Calif. For information:

CIRCLE 212 ON READER CARD

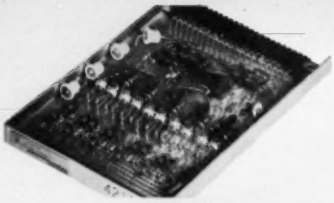
tape reader

Model 300 R tape reader utilizes a new design concept in data handling equipment. A printed motor is used to advance the paper tape asynchronously at rates up to 300 lines per second without the use of brakes, clutches or pinch rollers. The reels are driven by printed motors which are switched on and off by magnetic circuitry. The elimination of mechanical members in the capstan and reel drives result in a simple, reliable transport. PHOTOCIRCUITS CORP., Glen Cove, N. Y. For information:

CIRCLE 213 ON READER CARD

flip-flop circuits

A new series of quadruple flip-flops and capacitor-diode gating circuits has been added to the line of 500 kc static-logic system building blocks. The circuits permit such appplications



as parallel-serial conversion, up counting, down counting, up-down counting, binary-coded-decimal counting, storage, and set-reset applications. A new system building block mounting panel, which eliminates the need for soldered terminal connections is also available. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 214 ON READER CARD

flip-flop circuit module

A new quadruple-unit, RST flip-flop circuit module for memory or data storage functions in pulse logic systems is now available. With a standard operating frequency of 9 to 250 KC, the flip-flop has two modes of operation: Reset-set and trigger. In the trigger or binary mode, each input pulse changes the state of the flip-flop. In the reset-set mode, the circuits respond only to alternate set-reset pulses. This multiple unit consists of four complete independent circuits on a single plug-in board. ELECTRONIC-LOGIC CORP., 515 Boccaccio Ave., Venice, Calif. For information:

CIRCLE 215 ON READER CARD

density tape head

A high packing density tape head will resolve up to 10 kc per linear in. of tape movement. With the new heads deposited gap widths to 20 micro-in. are attainable and repeatable for production quantities. The heads are all metal in construction to provide prolonged headlife. These heads may be produced either in high or low inductance ranges and varying widths per customer requirements. GENERAL INSTRUMENT CORP., 3216 W. El Segundo Blvd., Hawthorne, Calif. For information:

CIRCLE 216 ON READER CARD

silicon switch

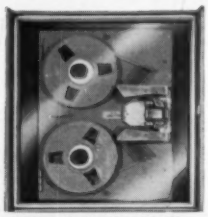
A super-speed, electronic switch that can more than double the output of today's computers according to the manufacturer, incorporates the avalanche mode silicon transistor in a microwave strip transmission line. Producing a clean rectangular pulse, the switch utilizes a reflection technique. Immediate applications of such a device include pulse generators, and other instrumentation circuitry. RAYTHEON COMPANY, Semiconductor Division, 200 First Ave., Needham, Mass. For information:

CIRCLE 217 ON READER CARD

OVER 100 BILLION BITS WITHOUT A DROPOUT!

RELIABILITY

WITH POTTER HIGH DENSITY RECORDING



906 II HIGH SPEED DIGITAL MAGNETIC TAPE HANDLER

TYPICAL CAPABILITIES OF POTTER HIGH DENSITY SYSTEMS

High Density Systems by Potter can include such outstanding characteristics as:

RELIABILITY:
Transient error rate . . . 1 in 10^{10} to 10^{9} max. at 1500 ppi
Permanent error rate . . . 1 in 10^{9} to 10^{8} max. at 1500 ppi
Reread time to recover transient errors . . . less than .005% of "on-line" time at 1500 ppi

BIT DENSITIES up to 2,000/inch

TAPE SPEED up to 150 ips

NUMBER OF CHANNELS up to 20 per inch of tape width

INTERCHANNEL TIME DISPLACEMENT Less than 0.2 microsecond at buffer output

INTERBLOCK GAP May be as short as 0.3"; 0.75" typical for dual read/write operation at 100 ips

ERROR DETECTION Parity channel provides single error detection

ERROR CORRECTION Single parity channel makes possible single error correction

AND MANY OTHERS write for details

For more than 40 hours of continuous operation, Potter High Density systems have recorded 100 billion bits without a single dropout. And — they've done it at the fantastic rate of 240,000 decimal characters per second. Only with the revolutionary new recording technique do you get this combination of extreme capacity with ultimate reliability.

In the 40-hour test, less than 2 seconds re-read time were required to recover information lost through transient error. More than 20,000 passes of the tape can be made without losing information or significantly increasing the reading error rate.

Tested and proven in computer systems, Potter High Density Recording is presently available in the Potter 906II High Speed Digital Magnetic Tape Handler, and will be available in other Potter Tape Systems.

Write today for details on how High Density Recording can be applied to your data handling problem.

POTTER INSTRUMENT COMPANY, INC. • SUNNYSIDE BOULEVARD, PLAINVIEW, NEW YORK

CIRCLE 33 ON READER CARD

COMPUTER SYSTEMS ENGINEERS

SALARY: TO $20,000

Several immediate openings exist at Hughes-Fullerton for Computer Systems Engineers qualified in the design and testing of large scale digital systems—and in the preparation of proposals for large scale digital computers.

These professional assignments involve such R & D areas as:

▪ Solid state digital circuitry involving millimicrosecond logic ▪ Microwave carrier digital circuits ▪ Sub-microsecond core memory ▪ Thin film storage techniques ▪ Functional circuit concepts ▪ Micro-miniaturization concepts ▪ Tunnel diodes ▪ Microwave parametrons ▪ Circuit organization for maximal-speed computing.

Located in Southern California's Orange County (the nation's fastest growing electronics center), Hughes-Fullerton offers you: a stimulating working environment; private or semi-private offices; long-term stability.

CALL COLLECT TODAY!
For complete information on these challenging assignments, call us collect **today!** Ask for:

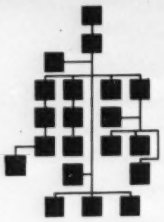
Mr. B. P. RAMSTACK at: TRojan 1-4080, ext. 3741.

Or, airmail resume to: HUGHES-FULLERTON R & D, P. O. Box 2097, Fullerton 1, California.

HUGHES

HUGHES AIRCRAFT COMPANY

CIRCLE 74 ON READER CARD



people moving up

★ D. L. Nettleton has been named chief engineer, RCA's Electronic Data Processing Division. He has been serving as engineering manager, RCA Data Communications and Customs Projects Department. This is one of three integrated departments recently formed in a realignment and expansion of the Electronic Data Processing Division. The other two are Commercial Systems and Industrial Computer Systems.

★ William P. Maughan has been named midwest regional manager for the Systems Marketing Division of Laboratory For Electronics, Inc. Boston. He will be responsible for all Systems Division marketing efforts in the midwest area and will continue to provide liaison between LFE and Wright Patterson Air Force Base.

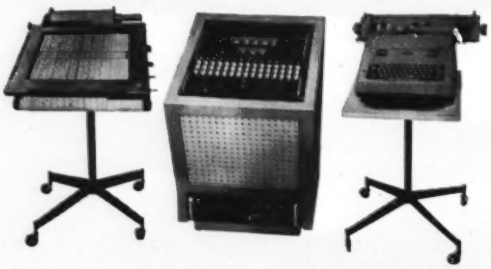
★ Gerrard F. Cunningham has joined Computer Control Company's staff of applications engineers as a specialist in digital systems applications. He will use the Framingham, Mass. office as headquarters. Formerly a senior engineer with Sylvania, he had the responsibility for course development and instruction of non-Sylvania engineers working in liaison with Sylvania on the BMEWS and MOBIDIC projects. He specialized on the digital systems connected with both.

★ Raymond B. Whitney has been named regional sales manager of the western region by Control Data Corporation's Computer Division. Prior to this appointment, he was with Alwac Corp. and the Computer Division of Bendix Aviation Corp.

★ J. A. Brustman has been appointed manager, electronic systems engineering of the advanced systems development engineering activity, RCA Electronic Data Processing Division. He is responsible for the advanced development of equipment for three sections which make up the Division.

★ Joe T. Ator, manager of the Industrial Systems Group, General Precision, Inc., has been appointed

From: GSI a versatile, practical Data Reduction System (Analogue to Digital)



1. Reads any type oscillogram with scale factor included.

2. Utilizes 4-digit voltmeter (0000 to ±9999), accurate to .01%, to measure proportional voltage of either X, Y or frequency potentiometers and display value in projection lamp bank.

3. Converts information to any type output desired—IBM typewriter, card punch, punched paper tape, plotter, etc.

Send for 4-page bulletin GADRS-2.

Outstanding Features:

- 15-channel capacity for X-Y or frequency
- 15-variable scale factors
- True and offset "0" locations—locate "0" reference for any curve at any point on graph
- Program switch for each channel for X-Y or frequency
- 16 mm and 35 mm projection systems available
- Modular construction, easily revised for increased work load or new applications
- Low cost—fast delivery

GSI

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Beckman Systems... a world-famous name that stands for the most advanced developments in Electronic Data Processing. Beckman research, study and engineering groups were the first to develop many of today's realistic answers to the ever-increasing demands for reliable, high performance data processing systems. Among them... Multiple Channel Recording, High-Speed Digital Processing, Solid-State Circuitry, and Floating, Low-Level Amplification. Systems applications include space vehicle guidance, automatic plant control, missile ground support and nuclear research.

At Beckman, the difficult problems are our business. Here, the selection of qualified engineers and scientists is as equally important as the problem at hand. In an atmosphere where initiative is encouraged and where achievement is well recognized, top men in the field are your associates in meeting the challenges of tomorrow. Both you and your family will heartily endorse Southern California living. World-renowned Disneyland, beach communities, desert resorts, and mountain areas all are minutes away.

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a division of Beckman Instruments, Inc.
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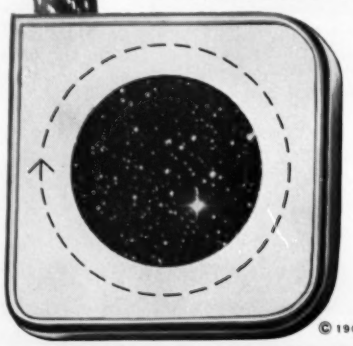

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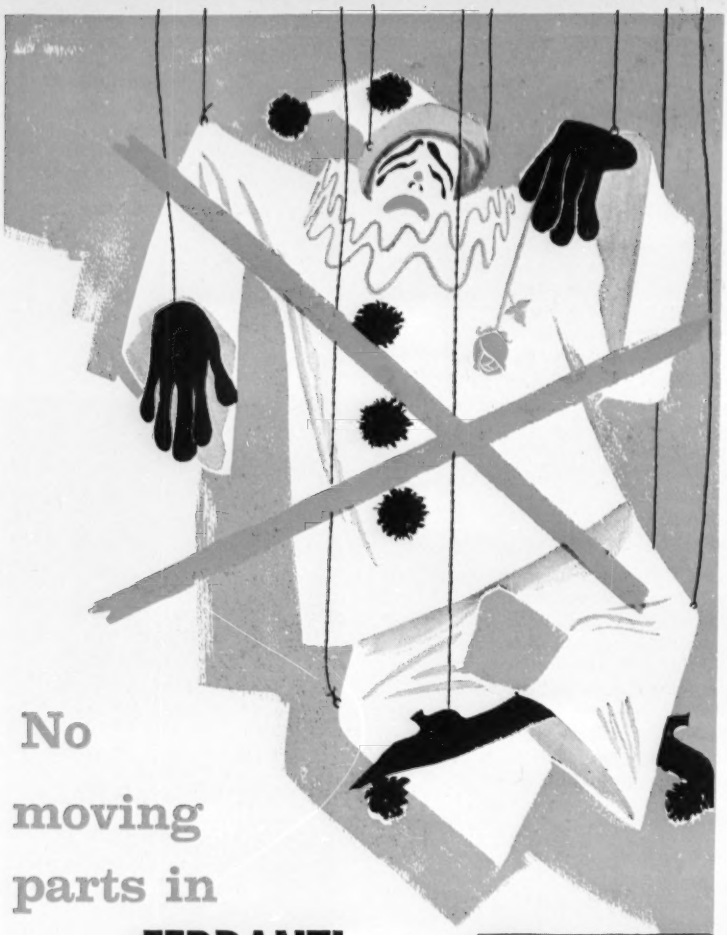
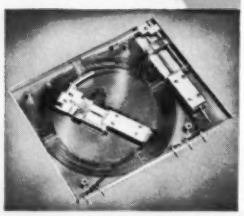


No moving parts in

FERRANTI Magnetostriction Delay Lines



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We can provide stock units that have been proved in performance — or custom design to your special applications.

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Write for detailed literature

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FERRANTI ELECTRIC, INC.
ELECTRONICS DIVISION
INDUSTRIAL PARK PLAINVIEW, N.Y.

CIRCLE 35 ON READER CARD

PEOPLE MOVING UP . . .

chairman of the Digital Computer Committee, Data Handling and Computations Division of the Instrument Society of America. Ator's committee will prepare portions of an encyclopedia on computer technology.

★ Gene E. Leary has been appointed manager of internal data processing of control data for Control Data Corporation. He will plan and supervise the processing of all internal accounting and payroll data by Control Data's computer center. Prior to joining the firm he was for four years manager of the Electronic Data Processing Department of Minneapolis-Honeywell Regulator Company's operations at Minneapolis.

★ William E. Lane has been named project engineer for the EDP Corporation, Orlando, Fla. He was formerly with the Martin Company where he developed a transistorized control computer for the Pershing Missile.

★ John L. Hawk has joined C-E-I-R, Inc. as director of its New York research center. He was formerly industry area manager of IBM's Advanced Systems Development Division, and also manager of the New York Data Processing Center for Service Bureau Corp. In his new position he will direct computing activites at the center and will be responsible for research being performed by the center's staff of computer programmers, mathematicians, and other personnel.

★ H. Thomas Ware, Jr., has been named manager of planning for IBM's Advanced Systems Development Division. Ware, who has been with the firm since 1946, was manager of market research for the division before this appointment.

★ Radio Corporation of America has appointed Harold N. Morris engineering manager for the firm's computer systems plant at Palm Beach Gardens, Fla. He joined RCA in 1954 and served the company in a number of positions.

★ Dr. Manlio B. Melillo has joined American Systems Inc., Hawthorne, Calif. He will manage a new magnetic components laboratory specializing in electroless coating of magnetic memory drums, disks, and rods. He was previously chief chemist for the Electrada Corporation.

High Density Recording System

A NEW HIGH DENSITY recording system can record as many as 190 300-page volumes of information on a single 10½ in. reel of tape. The Potter Instrument Company's system has a data transfer rate of 360,000 alpha-numeric characters per second, via 16 parallel recording channels on one in. tape, and at packing densities up to 1500 bits per inch.

It is reported that the system actually provides higher reliability than is expected of standard recording methods. Another reported advantage of the system is that it can eliminate restrictions formerly imposed on some computers by limitations of conventional peripheral tape handling equipment.

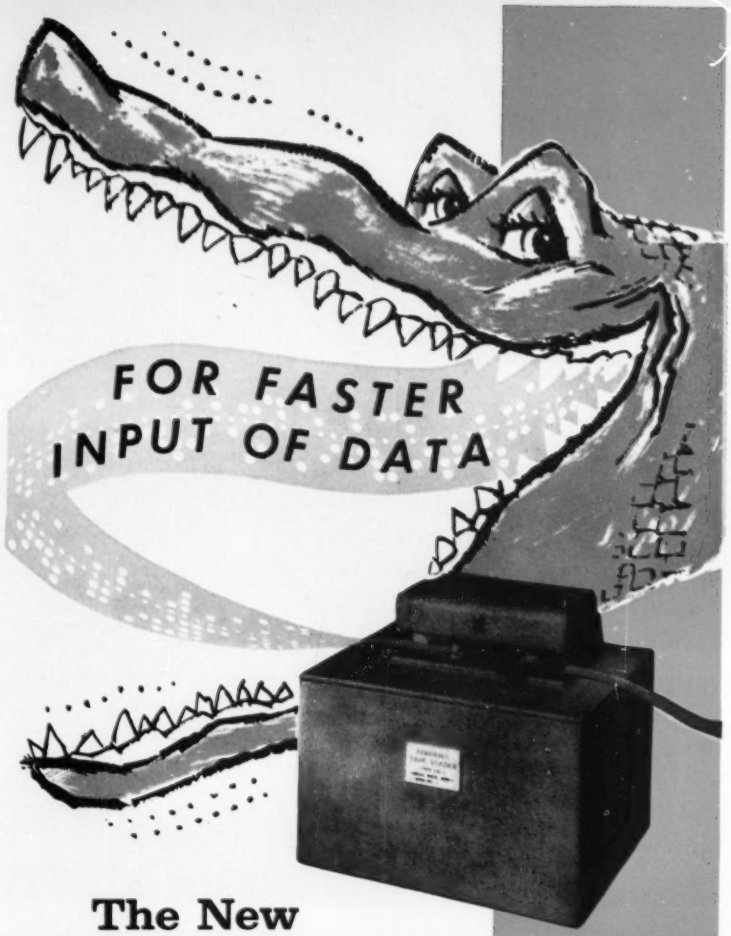
No separate clock channel is needed, and multi-channel data can be read out in true parallel form, despite interchannel time displacement. In a recent test of 40 hours continuous operation, less than two seconds of re-read time were required to recover data lost through transient error. During this time no permanent loss of information occurred. More than 20,000 passes over any portion of the tape can be made without losing information, or significantly increasing dropout rate.

First application of the system is incorporated in high speed tape transports for use with a Bendix G-20 computer destined for installation at Carnegie Institute of Technology, Pittsburgh, Penna.

The recording system is currently the core of a Doctoral program curriculum in "Systems and Communication Sciences," concerned with theories of programming, simulation of human cognitive processes and artificial intelligence.

Known officially to its creator as the Potter contiguous, double transition high density recording system, the equipment is largely the result of research and engineering work done by Dr. Andrew Gabor, senior engineer, and George Comstock III, Potter's chief engineer.

The computer will serve there as available with the Potter 906II high speed digital magnetic tape handler, and will also be available with other Potter tape transport systems.



The New
FERRANTI TR5
Transistorized
Tape Reader

This is an advanced design embodying broad experience gained from earlier Ferranti tape reader models.

It employs new transistorized circuits and a photoelectric system of reading . . . offers the advantage of speedier input of data, compactness, light weight.

Many design features to meet practical requirements of the user. Power supply is self-contained.

See us at the W.J.C.C. show—booth 43

Write for detailed information

TAPE WIDTHS:
5, 6, 7 or 8 level, all types and colors.

SPEED:
Any speed up to 330 chars/sec, under external control.

ELECTRONICS:
All solid state, including solar cell reading head, signal amplifiers, logical circuits, control circuits and power supplies.

INPUTS:
115V 60 cps 115 Watts power, —2 V 100 microamp start signal.

OUTPUTS:
8 signal outputs, + 1.5 to —3.5 V 5 milliamps plus reader ready signal.

SIZE:
9¼" x 11½" x 10"
Weight 32 lbs.

FINISH:
Gray wrinkle.

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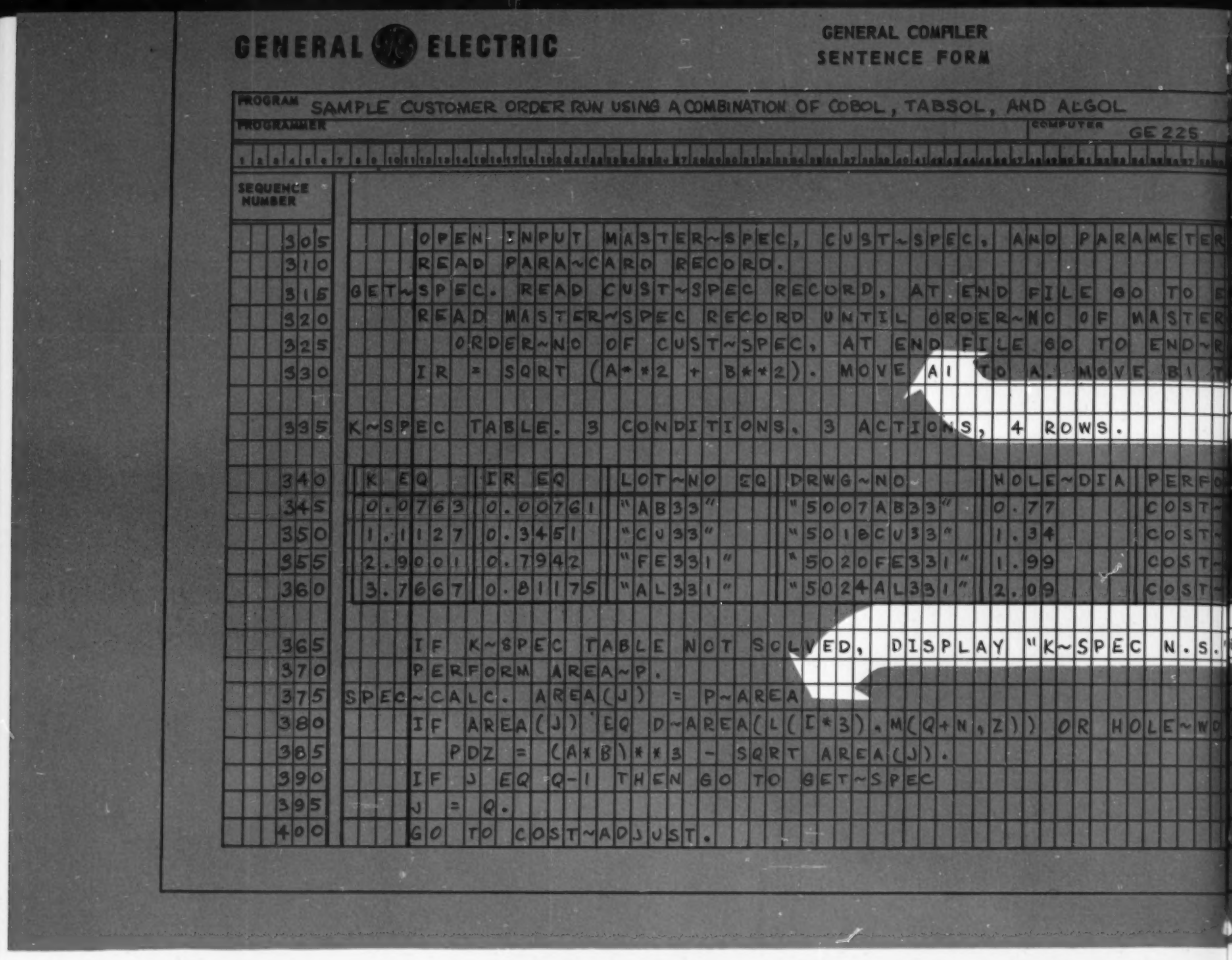
ELECTRONICS DIVISION
INDUSTRIAL PARK, PLAINVIEW, N.Y.

CIRCLE 36 ON READER CARD



GENERAL ELECTRIC

GENERAL COMPILER
SENTENCE FORM

PROGRAM: SAMPLE CUSTOMER ORDER RUN USING A COMBINATION OF COBOL, TABSOL, AND ALGOL
PROGRAMMER:
COMPUTER: GE 225

SEQUENCE NUMBER	
305	OPEN INPUT MASTER~SPEC, CUST~SPEC, AND PARAMETER
310	READ PARA~CARD RECORD.
315	GET~SPEC. READ CUST~SPEC RECORD, AT END FILE GO TO E
320	READ MASTER~SPEC RECORD UNTIL ORDER~NO OF MASTER
325	ORDER~NO OF CUST~SPEC, AT END FILE GO TO END~R
330	IR = SQRT (A**2 + B**2). MOVE AI TO A. MOVE BI T
335	K~SPEC TABLE. 3 CONDITIONS. 3 ACTIONS, 4 ROWS.

	K EQ	IR EQ	LOT~NO EQ	DRWG~NO	HOLE~DIA	PERFO
340						
345	0.0763	0.00761	"AB33"	"5007AB33"	0.77	COST~
350	1.1127	0.3451	"CU33"	"5018CU33"	1.34	COST~
355	2.9001	0.7942	"FE331"	"5020FE331"	1.99	COST~
360	3.7667	0.81175	"AL331"	"5024AL331"	2.09	COST~

365	IF K~SPEC TABLE NOT SOLVED, DISPLAY "K~SPEC N.S."
370	PERFORM AREA~P.
375	SPEC~CALC. AREA(J) = P~AREA
380	IF AREA(J) EQ D~AREA(L(I*3).M(Q+N,Z)) OR HOLE~NO
385	PDZ = (A*B)**3 - SQRT AREA(J).
390	IF J EQ Q-1 THEN GO TO GET~SPEC
395	J = Q.
400	GO TO COST~ADJUST.

GECOM... A UNIQUE CONCEPT IN

now available in the GE 225 ... and future General Electric general-purpose computers.

- processes COBOL, ALGOL and TABSOL*
- all problem statements easily read and understood
- extended usage ... re-programming unnecessary
- programs produced faster ... more efficiently

GECOM—the first truly GENERAL COMPILER SYSTEM—introduces a fresh, versatile approach to computer communication. Developed for the GE 225 computer, the GENERAL COMPILER *makes available all of the various proved programming techniques in one consistent, compact package.* No longer is it necessary to learn a dozen different programming systems to handle a full range of jobs effectively—each job is approached in *exactly the same way,* be it formula evaluation, a sort, or even a payroll. The language for describing any run is *consistent,* operating procedures and programming are *standard,* and documentation is readable and easily *understood.*

*A General Electric Trademark

THE GENERAL COMPILER PROVIDES–

A FAMILIAR LANGUAGE STRUCTURE—Problems need no be stated in machine code. The GENERAL COMPILE processes English language statements (COBOL Algebraic expressions (ALGOL), and Structure Table (TABSOL). It permits you to use all or any one of th computer languages ... as your needs require. Stil you have available the capability to expand, use othe languages and new techniques as your needs chang

A PROVED, ACCURATE CODER—Data Description an Problem Logic may be written in one, two, or a com bination of the available languages producing machine program of efficient, effective coding. Sinc the machine coding is derived directly from the log of the problem statement, it is only at the logic leve that debugging may have to be done.

A STANDARDIZED, UNDERSTANDABLE DOCUMENTATION Because GENERAL COMPILER problems are written familiar languages, they can be easily read and unde

GENERAL ELECTRIC'S NEW 225 GENERAL COMPILER

GECOM

COBOL

TABSOL*

ALGOL

Control Console and Central Processor of the GE 225 Information Processing System

COMPUTER COMMUNICATION

...ood. In addition, problem format provides a high ...egree of standardization. Programs written for ...day's machines in GECOM format can be used for ...ture General Electric computers—eliminating the ...ed for re-programming.

AN EFFICIENT, ECONOMICAL USE OF COMPUTERS—Per...nnel training time and expense are sharply reduced ...ince the novice programmer may use the familiar ter...inology of his profession. Manual coding is elimi...ated and debugging cut to a minimum. Thus, a ...achine program may be produced much faster and more efficiently than by present manual methods.

THE GENERAL COMPILER IS ANOTHER GENERAL ELECTRIC FIRST!

For more detailed information, write today for brochure CPB-144 on the new General Electric General Compiler. Also available: brochure CPB-101 on the GE 225 Information Processing System and CPB-81 on the GE 210 Data Processing System.

Write to: General Electric Company • Computer Department • Section 60J4 • Phoenix, Arizona.

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...eneral Electric—Pioneer in computer systems for all phases of business, industrial, scientific, engineering and financial endeavor.

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GENERAL ELECTRIC

CPA-60(4/61)

new DATAMATION literature

PRODUCT CATALOG: The second edition of this short form catalog describes new product lines in the fields of time code generators, timing systems auxiliary equipment, search and control systems for magnetic tape transports, data handling equipment and automation equipment. The four-page publication is designated as catalog No. 2. ELECTRONIC ENGINEERING CO. OF CALIF., 1601 E. Chestnut Ave., Santa Ana, Calif. For copy:
CIRCLE 260 ON READER CARD

OPERATOR'S HANDBOOK: A complete operator's handbook on analog computing provides an introduction to the capabilities and operation of general purpose analog computers. It is written as an operator's manual for the PACE TR-10 computer. For copy send $1.75 to ELECTRONIC ASSOCIATES, INC., Long Branch, N.J.

PRODUCT BROCHURE: A composite brochure of products complete with illustrations and ordering information for standard products and some specialized equipment is now available. The text discusses at length application considerations and circuit characteristics required for mechanical and electronic tape readers, tape perforators, coding keyboards, electrically sequenced typewriters, switching mechanisms, and perforator-comparator systems. SOROBAN ENGINEERING, INC., P.O. Box 1717, Melbourne, Fla. For copy:
CIRCLE 261 ON READER CARD

DIAL-O-VERTER SYSTEM: A new brochure describes the "Dial-o-verter" System and includes photographs of a magnetic tape terminal and a paper tape terminal. The 8-page publication also lists all the components of the system. DIGITRONICS CORP., Albertson, L.I., N.Y. For copy:
CIRCLE 262 ON READER CARD

G-20 COMPUTER: The G-20 computing system is described in this 18-page booklet. It details operational features, and includes recently announced improvements in computing, magnetic tape and line printer speeds. Basic, medium and large G-20 systems are depicted in the brochure. BENDIX COMPUTER DIVISION, 5630 Arbor Vitae, Los Angeles 45, Calif. For copy:
CIRCLE 263 ON READER CARD

COMPUTER COMPONENTS: A condensed catalog sheet covers the manufacturer's line of analog computer components. Included are illustrations, descriptions and basic specifications on amplifiers, stabilized operational six-packs and power supplies. EMBREE ELECTRONICS CORP., West Hartford, Conn. For copy:
CIRCLE 264 ON READER CARD

DIGITAL MAGNETIC TAPE HANDLER: The model 908 digital magnetic tape handler is described in this two-page bulletin. A complete list of specifications plus a description and technical summary of the unit is included. POTTER INSTRUMENT CO., INC., Plainview, N.Y. For copy:
CIRCLE 265 ON READER CARD

TAPE BULLETIN: The applications and advantages of a new type of magnetic tape with higher recording densities, more tracks and greater accuracy are contained in this bulletin. AUDIO DEVICES, INC., 444 Madison Ave., N.Y. 22, N.Y. For copy:
CIRCLE 266 ON READER CARD

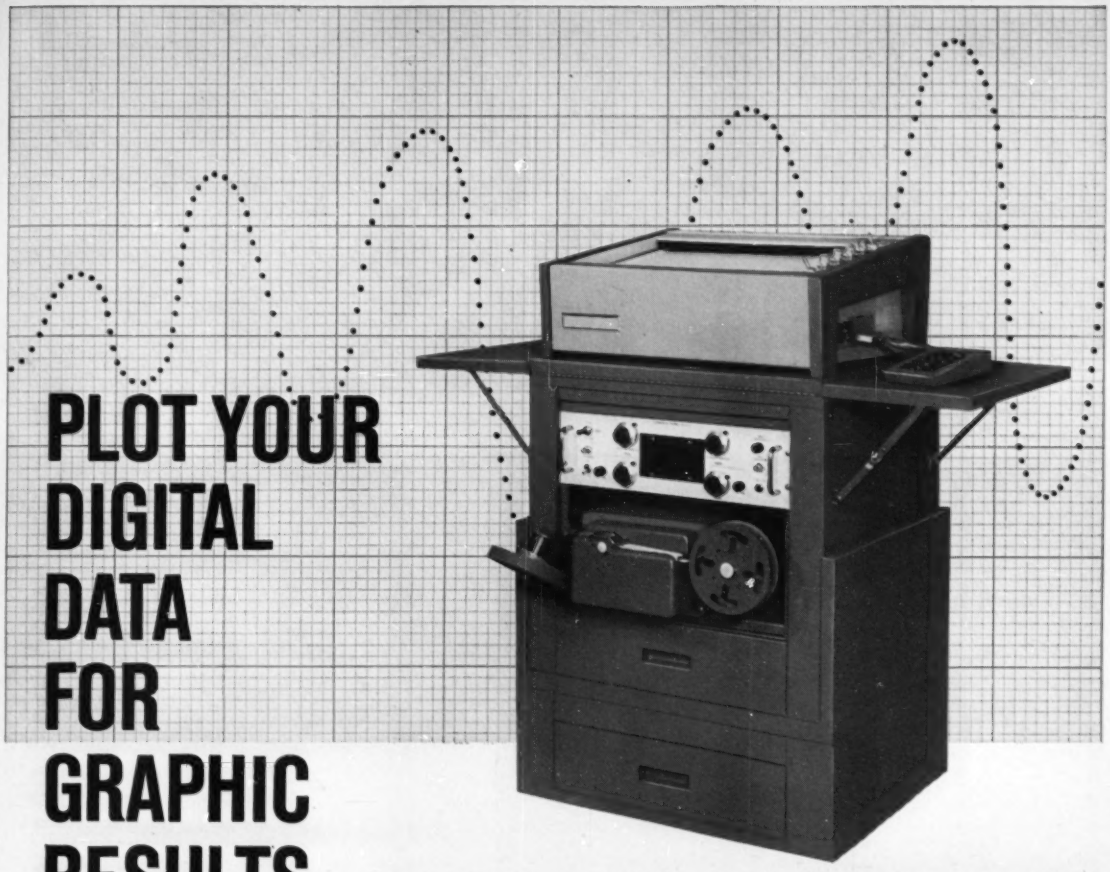
COMPUTER ELECTION REPORT: A 16-page booklet gives an hour-by-hour breakdown of the operations of a 7090 during the presidential election night last November. Problems encountered and solutions are also included. INTERNATIONAL BUSINESS MACHINES CORP., 590 Madison Ave., New York 22, N.Y. For copy:
CIRCLE 267 ON READER CARD

HIGH SPEED PRINTERS: Two basic models of the series 4 high speed printers are described in this bulletin. Performance characteristics, specifications and applications are included. ANELEX CORP., 150 Causeway St., Boston 14, Mass. For copy:
CIRCLE 268 ON READER CARD

PORTABLE ANALOG COMPUTER: The model 3500 analog computer, a unit weighing 28 lbs, is described in this brochure. It can be used to study almost any physical system that can be described by differential equations. DONNER SCIENTIFIC CO., Concord, Calif. For copy:
CIRCLE 269 ON READER CARD

MILITARY COMPUTER APPLICATIONS: This six-page brochure includes information on the use of computers

TEST
EQUIPMENT
DESIGN
Electronic diagnosis? Can you design and build equipment to isolate operational malfunctions in complex electronic and electro-mechanical systems? Required: experience with transistorized circuitry, digital or analog computing techniques, and/or sub-miniature electro-mechanical devices and associated electronics. Write to Mr. Donald Krause.
LITTON SYSTEMS, INC. Guidance & Control Systems Div.
Beverly Hills, California



PLOT YOUR DIGITAL DATA FOR GRAPHIC RESULTS ... *WITH ACCURATE, LOW COST EAI SERIES 3100* DATAPLOTTER

The full potential usefulness of digital computer calculations is seldom fully realized. Because of the excessive cost of hand plotting, the benefits of graphic displays of digital data are usually sacrificed. Now, with the DATAPLOTTER 3100, this lost dividend can be recovered.

The quickest and easiest way to analyze the voluminous output of digital computers is in the form of easy-to-read x-y charts. With graphs plotted on the EAI Series 3100 [11"x17"] DATAPLOTTER, digital information achieves new accessibility and convenience for computer data users. This new low-cost digital plotter enables project groups to set up independent data interpretation operations utilizing information obtained from central computer services. Experience shows that this equipment will deliver plots more rapidly and accurately and free valuable man-hours for engineering and management.

Outstanding Features of the EAI Series 3100 DATAPLOTTER include:

- System accuracy up to 0.175% of full scale.
- Punched card, tape or keyboard input.
- Plotting speeds up to 80 points per minute.
- Provisions for "off-board" origin.
- Compact, self-contained single cabinet design. Punched card reader external.
- Adaptable to any computer system.
- Accepts analog as well as digital inputs.
- Automatic off-scale point rejection.

Some of the applications in which the EAI Series 3100 DATAPLOTTER is extremely valuable include Frequency Response Curves • Fluid Flow Charts • Stress Analysis • Aerodynamic Studies • Chemical Reaction Rates • Missile Trajectories and Orbits • Thrust Studies • Flight Data • Sales and Market Analyses.

EAI Series 3100 DATAPLOTTER® can save you money and improve your engineering and computer services. For information on this new equipment, write to Department 71.

EAI ELECTRONIC ASSOCIATES, INC. *Long Branch, New Jersey*

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NCR NCR NCR NCR

COMMERCIAL EXPANSION CREATES
IMPORTANT OPENINGS FOR

DIGITAL COMPUTER ENGINEERS & PROGRAMMERS AT NCR, LOS ANGELES

These are immediate openings, created by the heavy increase in commercial activity at our rapidly growing Electronics Division in Los Angeles. We're looking for the best men in the field, and the opportunities we offer reflect our determination to find them. We plan to fill the new openings quickly. Your prompt reply will be appreciated.

COMPUTER ENGINEERS
Senior and Intermediate

Experienced graduate E.E.'s with 3 to 5 years in logic design and transistorized circuit design of digital equipment. Assignments will entail logic and circuit design of buffer storage units and digital peripheral equipment.

SENIOR PRODUCT DESIGN ENGINEER

Expanding commercial program offers excellent opportunity to apply advanced techniques in miniaturization. Applicant should have ME degree and substantial experience in packaging techniques for core-type memories and complex digital systems. Should also be capable of product design analysis and technical liaison to develop a producible product.

SENIOR SOLID STATE DEVICE ENGINEER

An important position entailing investigation of semiconductor devices for purpose of establishing mathematical models and design parameters used in circuit design. Requires minimum of three years' experience and some background in computer circuitry, transistors, diodes, resistors, and transient phenomena. Should be familiar with characteristics, analysis, and mathematical models of various semiconductors, such as alloy transistors, diffused-base transistors, mesa transistors, and diodes.

SENIOR PROGRAMMERS

Advanced developments in the design of data-processing equipment for world-wide markets have created a number of important openings for people with several years of programming experience. Selected persons will have the opportunity of working with other Senior Programmers in one of the most challenging areas of programming – the design and construction of automatic programming systems. The group will be specifically responsible for developing compilers, service routines, complete monitoring routines, application-oriented generators for new and unique general purpose data-processing machines. The group is also expected to create and implement new programming systems projects for future equipment complexes.

SYSTEMS ENGINEERS

Experience required in formulating functional design specifications for digital computer systems (buffer storage, punch card, paper tape, magnetic tape, random access devices, system organizations, command structures). Training in logical design, data-processing systems and programming techniques desirable. Assignments entail formulating functional specifications for business computers.

CONFIDENTIAL INTERVIEWS AT THE WESTERN JOINT COMPUTER CONFERENCE IN LOS ANGELES, MAY 9-11
To arrange an appointment, please send your resume immediately to Norval E. Powell, Personnel Manager, at the address below. We will confirm your appointment promptly.

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CIRCLE 76 ON READER CARD

NEW LITERATURE . . .

in connection with the military services. GENERAL ELECTRIC, Light Military Electronics Department, Utica, N.Y. For copy:
CIRCLE 270 ON READER CARD

CUSTOMER ASSISTANCE: A four phase program is outlined for customer service in electronic data processing systems. A list of the facilities and services is included. RADIO CORPORATION OF AMERICA, Electronic Data Processing Division, Camden, N.J. For copy:
CIRCLE 271 ON READER CARD

COMMUNICATIONS PRINTERS: High speed print-out of data transmitted over telephone, telegraph or radio links is the topic of this four-page brochure. Specifications and applications are included. STROMBERG-CARLSON, P.O. Box 2449, San Diego 12, Calif. For copy:
CIRCLE 272 ON READER CARD

MAGNETIC MEMORIES: Series 3100 magnetic memories is described fully through the use of text diagrams and photographs. A list of applications is also contained in the publication. RESE ENGINEERING, INC., 731 Arch St., Philadelphia 6, Penna. For copy:
CIRCLE 273 ON READER CARD

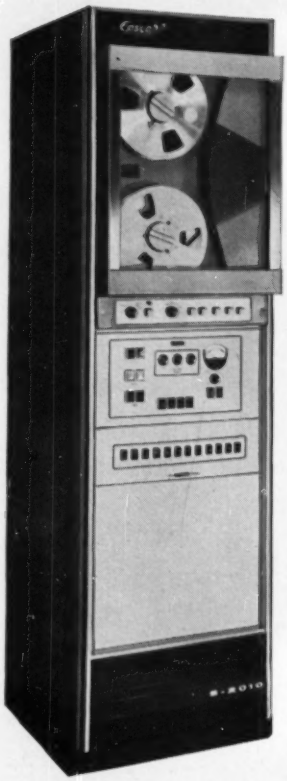
MINIATURIZED MEMORY PLANE: Operational data, typical values, type of construction and criteria for data are highlighted in this brochure on a memory matrix using ferrite cores. GENERAL CERAMICS, Keasbey, N.J. For copy:
CIRCLE 274 ON READER CARD

DATA PROCESSING SYSTEM: The 2000 electronic data processing system is broken-down and described in this information kit recently made available. The central computer, magnetic drum storage, magnetic tape system, high speed printer and paper tape system are described. PHILCO CORP., Computer Division, Willow Grove, Penna. For copy:
CIRCLE 275 ON READER CARD

SWITCH LINE: Applications, materials and characteristics of a complete line of switches are detailed in a 48-page catalog. THE DAVEN CO., Livingston, N.J. For Copy:
CIRCLE 276 ON READER CARD

FOREIGN LITERATURE: A 22-page Government report entitled "Chinese Communist Development of Teleprinter and Facsimile Equipment" has been published. Send 75 cents to OTS, BDSA, U. S. Department of Commerce, Washington 25, D. C.

IN HIGH-SPEED DIGITAL PROCESSING
EPSCO DELIVERS ITS SPECIFICATION



DATA REDUCTION PROBLEMS?

NEW **S-2010** COMPUTER FORMAT RECORDER automatically records continuous incoming data in gapped computer format. Accepts any arbitrary data asynchronously or synchronously and at varying rates.

Epsco's new solid-state S-2010 is a universal recording unit which accepts digital data from a wide variety of sources and records it on magnetic tape in any specified digital computer format.

Used in conjunction with a digital output data gathering system, the S-2010 automatically processes data into computer-acceptable form, saving hundreds of man-hours of data reduction and hundreds of computer translation hours in reprocessing raw data into a form suitable for high speed computation.

As the data recording rate of the S-2010 is limited only by the maximum tape writing rate of the particular computer format, multiple channel data acquired at high sampling frequencies can be processed directly onto computer format magnetic tape.

Twin, coincident-core memories permit continuous incoming data to be recorded as gapped computer-format records with no loss of data. The S-2010 automatically generates all necessary gaps, parity bits, end of record, end of file and finish marks.

The S-2010 — a transistorized version of Epsco's famous vacuum-tube S-2000 — offers much greater compactness (1 cabinet instead of 3) and increased reliability.

A complete spectrum of standard options can be added to the basic unit to create systems exactly tailored to specific needs.

Write or call Epsco for S-2010 brochure.

SPECIFICATIONS

Memory: Two, alternating, 5μ sec coincident current core memories. Operates in push-pull mode for continuous data input; in tandem mode for intermittent data input. Plug-in memory modules of 256 characters each, available for expanding capacity. Choice of 256, 512, 768 or 1024 character capacity, in push-pull mode; up to 2048 character capacity in tandem mode. Choice of manual as well as automatic memory load. Memory verification read-out to line-at-a-time printer available.

Modes of Operation: Continuous or start-stop. Binary or BCD output. Variable record length control. Data programming. Self-checking test mode. On-line or off-line monitoring. Single or double memory operation. Data source control.

Construction: All solid-state, with quick-change, indexed plug-in circuit cards. Key logical elements have indicator lights, and all cards have test points brought out and identified.

Dimensions: Standard models, one standard 19-inch cabinet, 82" h x 22" w x 24" d.

Operating Environment: Temperature 32° F to 100° F, cooling by built-in ducting and blowers. Relative humidity: up to 90%. Altitude: up to 8000' above sea level.

Thermal Dissipation: 2250 BTU (mean).

Power Requirements: 105 to 125 volts A.C., 60 cps. single phase, approx. 6 amperes.

Epsco SYSTEMS

A Division of Epsco Incorporated, 275 Massachusetts Ave., Cambridge 39, Mass., UNiversity 4-4950

CIRCLE 39 ON READER CARD

it's
TIME
to investigate

PARABAM DIGITAL CLOCKS

The Parabam Digital Clock provides accurate time-of-day for...

- ★ PROGRAMMING
- ★ PROCESS CONTROL
- ★ DATA PROCESSING
- ★ COMPUTING SYSTEMS
- ★ TEST DATA RECORDING

up to 86,400 contact combinations.

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- 24 hour or 12 hour AM-PM configurations.

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for Technical Bulletin No. 460-5 on the Parabam Digital Clock.

PARABAM
DIVISION OF HOUSTON FEARLESS CORPORATION
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CIRCLE 40 ON READER CARD

National Telemetering Conference

SCIENCE and Education in Telemetry" is the theme of the 1961 National Telemetering Conference. The annual conference is scheduled for the Sheraton Chicago Hotel, Chicago, May 22-24. Fifteen technical sessions will be presented during the three day conclave. Following is the technical program.

MONDAY, May 22

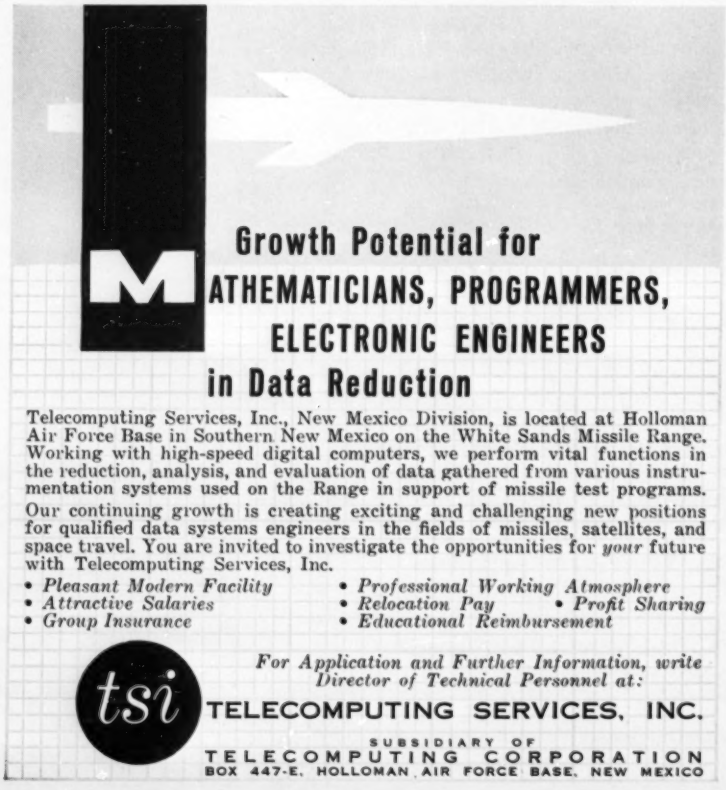
1. Workshop: Telemetry Standards 9:30-11:30 a.m.
2. Industrial Telemetering 9:30-11:30 a.m.
3. Transducers 9:00- 4:30 p.m.
4. Advanced Systems Techniques I 2:00- 4:30 p.m.
5. Data Processing and Presentation 2:00- 4:30 p.m.

TUESDAY, May 23

6. Workshop: Telemetry in Europe 9:00-11:30 a.m.
7. Signal Conditioning 9:00-11:30 a.m.
8. Flight Test Data Systems 9:00-11:30 a.m.
9. Workshop: Telemetry Education 1:30- 4:00 p.m.
10. Advanced Systems Techniques II 1:30- 4:00 p.m.

WEDNESDAY, May 24

11. PCM Systems I 9:00-11:30 a.m.
12. Underwater Measurement 9:00-11:30 a.m.
13. Bio-Medical Telemetering 2:00- 4:30 p.m.
14. PCM Systems II 2:00- 4:30 p.m.
15. RF Components and Techniques 2:00- 4:30 p.m.



Growth Potential for MATHEMATICIANS, PROGRAMMERS, ELECTRONIC ENGINEERS in Data Reduction

Telecomputing Services, Inc., New Mexico Division, is located at Holloman Air Force Base in Southern New Mexico on the White Sands Missile Range. Working with high-speed digital computers, we perform vital functions in the reduction, analysis, and evaluation of data gathered from various instrumentation systems used on the Range in support of missile test programs.

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CIRCLE 77 ON READER CARD

Plus & Minus...

by Herb Grosch

THE MOST IMPORTANT single characteristic of the digital computer is its generality of application. Fantastic, almost limitless speed is important; so is the economy that speed makes possible. And system reliability, whether due to component improvement or sophistication in logic, lets us envisage robot lunar probes and banking without statements. But it is, before everything else, the G in GP that makes our daemon so powerful. An ant is less than a man, not because it is small, not because it is short-lived, but because it is preprogrammed.

This was one of the battlefields of the musty old analog-digital war, fought when most of the readers of this column didn't know binary digits from bubble gum. The current weedy luxuriance of the programming business is a shuddersome monument to the definitive victory of General Purposeness.

In case you think the matter is closed, though, just look at the news. A novel large-capacity memory is developed for language translation experiments, although the difficulties are clearly all on the linguistic side. The Army proudly unveils a ruggedized, expensified mobile computer, and immobilizes it in a German warehouse where a 705 or a UNIVAC I could have been at work three years ago. The FAA apologizes for a few hundred deaths, and mentions that a special computer is a little late in appearing – to do a 205-size job, two years too late. Contracts are proudly let for missile checkout gear, while right down the pad a more powerful GP handles range safety. A bank puts a poor little $4 billion a year company in the computer business, to build a "special" computing system and a check sorter (the latter was subbed out!)

These charlatanries are not inevitable. The recent Air Force policy has been most admirable; BMEWS, SACCS, and the weather system all use standard large general purpose machines, and tie them to the necessary special hardware. The savings must be in the tens of millions, and we owe the AF a professional vote of thanks as well as taxpayer gratitude.

As long as there is a proud customer, ignorant money, and a greedy supplier – that is, as long as the earth turns – similar situations will arise. We should attempt, as individuals and through our organizations, to encourage the white hats and unmask the black hats.

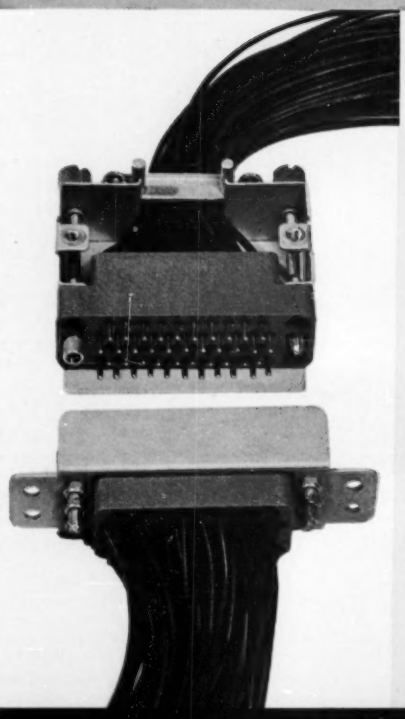
CIRCLE 41 ON READER CARD →

THESE SNAP-IN CONTACTS

OF CEC's 500C CONNECTORS

ASSURE AN AVERAGE VOLTAGE DROP

OF LESS THAN 3 MV AT 5 AMPERES



Low contact resistance makes CEC's line of 500C miniature electrical connectors ideal for dry circuit applications. These rectangular connectors are designed to exceed the requirements of MIL-C-8384A.

The series is available in a range of 14 to 104 contacts with mounting hardware for flush or surface installation, straight or right-angle cable entrance and guide-pin or jackscrew mating. The size 20 contacts of the line accommodate AWG wire sizes 20 thru 26.

Write for Bulletin CEC 4004-X1.

Data Recorders Division CEC

CONSOLIDATED ELECTRODYNAMICS / pasadena, california

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Optical recognition in Great Britain

THE SOLARTRON READER

SOLARTRON Electronic Reading Automation averaging approximately 200 characters per second, is Great Britain's recent contribution to the field of optical scanning equipment.

Developed at the Farnborough plant of the Solartron Electronics Group Ltd., the machine reads lines of characters printed on a continuously moving roll of paper. Lines consist of letters and numbers up to a maximum of nine with each character composed of two letters and up to seven numbers.

The operation of Solartron is as follows: a cathode ray tube in conjunction with its associated circuits, produces a spot of light. This spot of light traces on a tube which faces a number of parallel lines known as a "raster."

The lens projects the image of the raster onto the character and as the image of the spot passes over the paper, light is reflected. These light variations are "picked-up" by a photomultiplier cell which has the property of converting the variations into electrical signals.

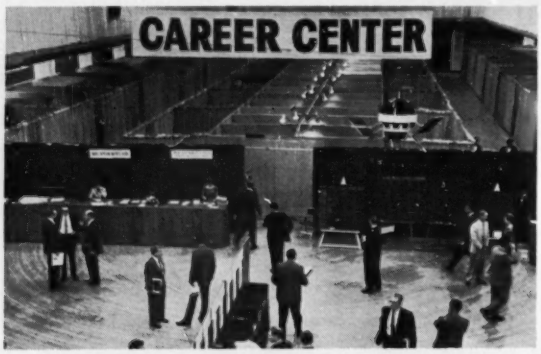
The amount of computation print out of any roll, depends upon activities at the point of origin. While information is being processed, the computer cannot accept further data until a particular operation has been completed. In this situation, a "busy" signal is fed back to the reader which holds the roll stationary until the computer is ready to begin again.

Should the character reader not be able to decipher a figure, the audit roll passing through the machine will stop automatically. This permits the operator to the character or manually key in the information needed.

It is claimed that Solartron operates 180 times faster than manual card punching and verifying and permits a reduction of labor costs of approximately 30 times if the machine can be loaded to capacity.

Lengths of audit paper rolls used on one model of the machine, vary from 20 inches to 48 feet. Width is 2 inches. These paper lengths represent a minimum of three lines to a maximum of 2,000. A major use of the machine has been to read tally rolls from cash registers and similar printing devices.

Solartron engineers say they chose optical rather than magnetic character recognition since the latter has a higher resolution and can sense and use more of the information available on paper.



America's Top Employers Interviewing Engineers In Los Angeles May 9-11

Experienced engineers and scientists are invited to register for confidential interviews at this employer sponsored Career Center, May 9-11. No fees or charges.

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LOCATION:
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(3405 Wilshire Boulevard, just across the street from the Ambassador Hotel, headquarters for the W.J.C.C.) Plenty of parking!
TELEPHONE: DUnkirk 2-8111

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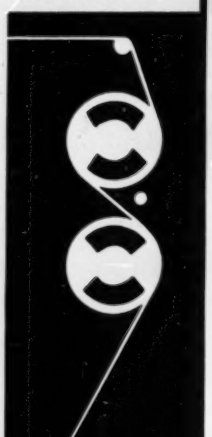
COMPUTER SERVICES



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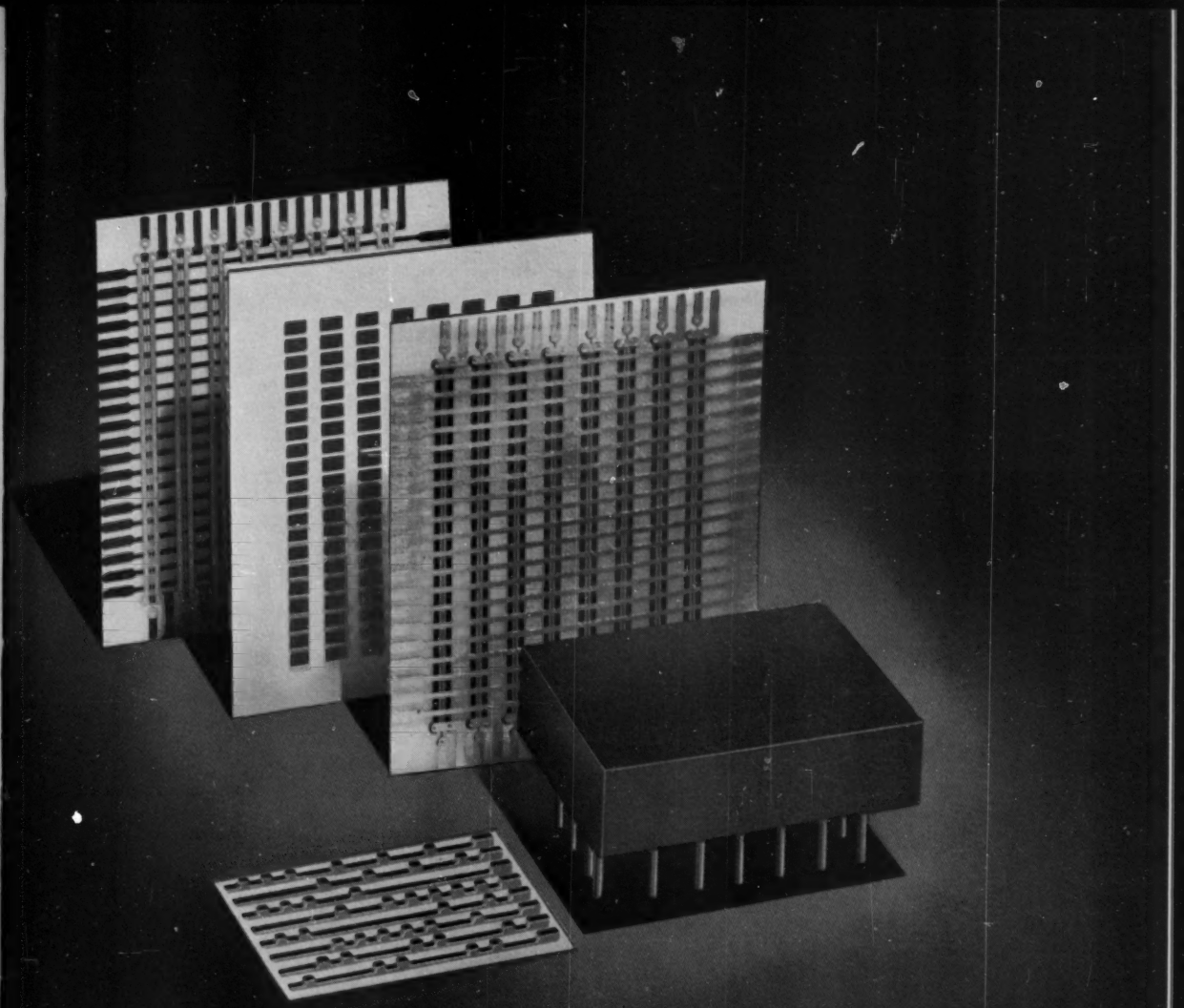


TAKEN FROM TOMORROW

BIPCO™ Modules — Built-In-Place Components In Modular Form . . .

The Burroughs Corporation announces the commercial availability of tomorrow's techniques . . . today. BIPCO modules combine the reality of performance, low cost and immediate availability, to signal a major transition in the state of the art.

Thin Film Memory Planes and Solid State Multi-element Modules are the first of the BIPCO module family. The Thin Film Memory is capable of storing 20 words of 8 bits each for a total of 160 bits of information, and has a cycle time of 0.2 microsecond. The Solid State Module is a binary coded decimal to decimal diode converter which utilizes 40 diodes in matrix logic.

Burroughs Corporation's breakthrough in Built-in-Place Components is made possible by the unique combination of two major new techniques. First, multi-element components are simultaneously fabricated within a single device. Second, these elements are placed in a predetermined pattern in such a manner as to facilitate complex internal connections.

This combination of techniques has resulted in BIPCO Modular Devices with simple inputs and outputs which perform functions normally requiring myriads of elements and connectors.

Write for BIPCO Module Technical Brochure.

CIRCLE 43 ON READER CARD

ANOTHER ELECTRONIC CONTRIBUTION BY

Burroughs Corporation

ELECTRONIC TUBE DIVISION

Plainfield, New Jersey

Functions with Bell System Data Phone 200

DIAL-O-VERTER FOR DATA TRANSMISSION

ANOTHER new electronic system which transmits data over the regular telephone network has been developed. The Digitronics Dial-o-verter System was created to function with the Bell System Data Phone 200 at a speed of 1,500 words per minute.

"The Dial-o-verter System makes possible the transmission and receipt of volumes of data, to and from many remote locations, at high speed," stated Albert A. Auerbach, Digitronics president.

The new system can replace low-speed, electro-mechanical equipment. Currently, data may be transmitted over private telephone or telegraph lines at a speed of 6 to 10 characters per second. The Dial-o-verter System operates via Data-Phone at a speed of 150 characters per second.

"When using the Dial-o-verter System and Data-Phone, a person can dial, and the person at the other end is ready to send or receive data in machine language," stated Mr. Auerbach. "This system can bring information from plants to data processing centers, or from office to office, with more flexibility than private telephone or telegraph lines.

"The Dial-o-verter System checks the line for transmission, before it permits data to be sent. Other features include error reporting, error retransmission options, and double parity," continued Auerbach.

The Dial-o-verter System reads or writes data via punched paper tape, punched cards or magnetic tape. It can transmit data in one medium at one point, and have it received in another medium at the other point. A plant can send paper tape, and have it produced either as cards or mag netic tape at the computer center, or vice versa.

Using the regular telephone network via Data-Phone, data may be transmitted at regular local or long distance rates. It refuses to send data unless the transmission line is acceptable, and permits unattended operation.

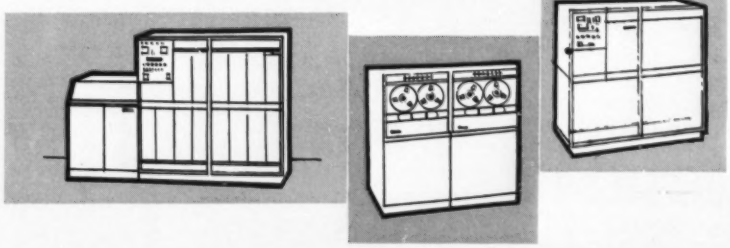
Since data to be transmitted may be left in a loaded position on Dial-o-verter, no personnel are required at remote stations. A single operator at the data center can handle the entire operation.

The Dial-o-verter System is based on the Digitronics Model D599SR coupler, which forms the interconnection between the Bell System Data-Phone 200 and any of the data media commonly in use, such as paper tape, punched cards or magnetic tape. When transmitting, it is used with a high-speed perforated tape reader, but also can function with a card reader or magnetic tape handler. When receiving, the coupler functions with a high-speed paper tape punch, a card punch or a magnetic tape handler.

CIRCLE 104 ON READER CARD

NEW ACOUSTICAL BATS SILENCE COMPUTER SOUNDS

Available in 33-yd. rolls (72" wide) or in cut parts. Black or gray.



High-speed business machines just can't "think" without making some noise. Luckily, Western Felt has found the way to muffle that noise to a murmur.

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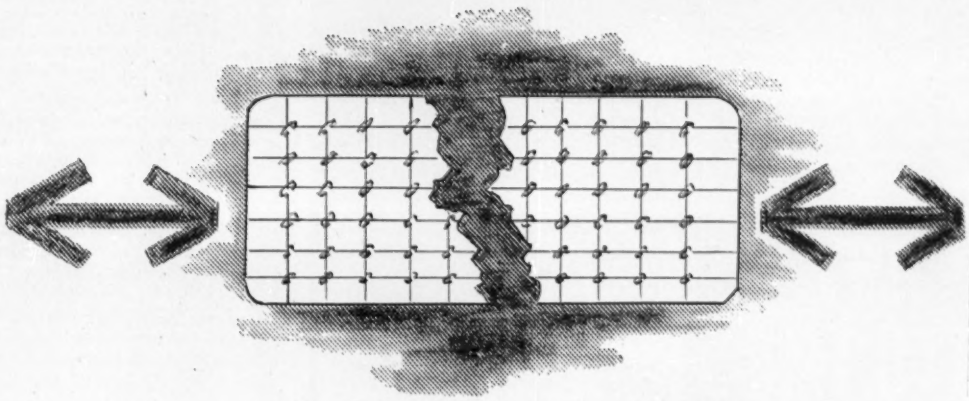
CIRCLE 44 ON READER CARD

OPPORTUNITIES AT THE OUTER EDGE OF COMPUTER SCIENCE...



SCHIZO-PROGRAMMING*

***SCHIZO-PROGRAMMING.** *This is a symbolic representation of an experimental, split-memory multi-programming technique now being investigated. One portion of the machine memory will be used for continuous scientific computations. The other, for real-time data handling problems that put random instantaneous computational demands on the computer. For this unusual problem mix, intricate programming systems are being analyzed and prepared for the efficient space-sharing of the IBM 7090 magnetic core memory and time-sharing of its central processing unit.*

Home of the General Motors Research Laboratories consists of these eight buildings making up part of the 330-acre GM Technical Center. This modern campus of technology is located in suburban Warren, 13 miles north of downtown Detroit and within easy driving distance of top Michigan and Canadian recreational areas.

The latest computers can carry on many operations simultaneously—with part of their memory units completely unaware of what another part is doing. This demands a new level of sophistication for programming systems.

Here at the General Motors Research Laboratories, the development of such advanced programming techniques is part of a long-term effort aimed at extending the sensor, problem-solving, and motor capabilities of computers. If you are interested in projects at the outer edges of computer science—where you are free to discover and can do your most constructive work—investigate the many opportunities in our growing computer staff.

Immediate non-routine assignments, many at the senior level, are now open in these areas: **PROGRAMMING SYSTEMS ... PATTERN AND CHARACTER RECOGNITION ... NUMERICAL ANALYSIS ... PROBLEM-ORIENTED LANGUAGES ...** and **NUMERICAL CONTROL.**

For those qualified in any of these areas, we invite you to . . .

Discuss the unusual growth opportunities at GM Research with management members of our computer staff while attending the **WESTERN JOINT COMPUTER CONFERENCE** in Los Angeles, May 9, 10, and 11. Call Mr. D. E. Hart, Head of the Digital Computations Department, at DU 7-5134 Tuesday through Thursday to arrange a convenient appointment or . . .

Send us a brief résumé today. Write:

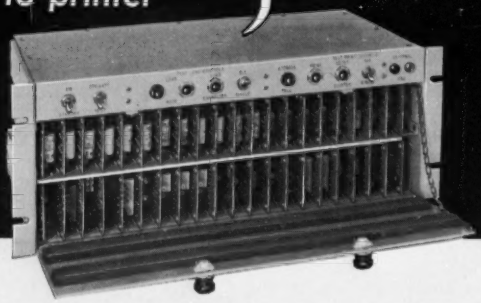
Mr. J. B. Sparhawk, Personnel Staff

General Motors Research Laboratories

WARREN, MICHIGAN

CIRCLE 79 ON READER CARD

tape to printer
card to printer
processor to printer
adc to printer
BUFFERS



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CIRCLE 45 ON READER CARD

Within 20 years . . .

Bi-lingual Telephone Calls

AN INTELLIGIBLE telephone conversation from continent to continent with different languages being spoken on either end of the line will be possible within the next 20 years through advanced communications and data processing devices, Dr. Edwin G. Schneider of Sylvania Electric Products Inc. said recently.

"The basic computer mechanism for automatic translation is already in existence, although primitive," he said. "To complete the translation for spoken words, it will be necessary to automatically recognize the basic sounds of speech, independent of the peculiarities of the speaker, and to reconstitute these sounds from information stored in the computer memory."

"Rudimentary translation of Russian into English is currently being carried out by a computer," Dr. Schneider said. "A Russian-English dictionary is coded and stored in the computer memory. The document to be translated is typed out on punched paper tape and fed into the computer, which looks up the corresponding words in the other language. The document is then typed in translated form."

He said the problem of translation of spoken words does not appear very formidable "when one considers that there are only 40 basic sounds used in English. To date, a relatively high degree of success has been achieved in generating recognizable speech by piecing together the appropriate artificially generated speech sounds."

"The process of automatically recognizing the basic sounds has so far only been solved for very limited cases. For example, fairly reliable recognition of vowels clearly spoken by a male voice has been accomplished – but the same equipment was unable to understand women. Maybe this was because the men who made the machine didn't understand women either."

Dr. Schneider said, however, there is little doubt "that a solution for the speech pattern recognition will be found, and it will have applications beyond that of automatic translation." Applications cited were more efficient use of phone lines – carrying 100 conversations over a channel which now carries only one, and a "speech typewriter," which would reproduce a spoken statement in document form.

OPTIMIZATION AND DIGITAL COMPUTATION

Challenging openings, including those of group leaders, are available for qualified applied mathematicians and digital computer programmers having B.S., M.S., or Ph.D. degrees for research in the mathematical analysis and simulation of complex systems. These positions offer an excellent opportunity for increased professional growth as a member of an outstanding and stimulating scientific staff, where publication of technical papers is continually encouraged. Advanced research in these vital fields of applied mathematics will open vast new areas of computer applications. Immediate openings are available at either our *Chicago* or *Washington, D. C.* area facilities for individuals with experience in one or more of the following fields . . .

- DIGITAL COMPUTER SIMULATION
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- LINEAR AND NON LINEAR PROGRAMMING
- THEORY OF COMPUTING ALGORITHMS
- DESIGN OF COMPUTATIONAL EXPERIMENTS
- ANALYTICAL STATISTICS
- INFORMATION SYSTEM STUDIES
- GAME AND QUEUING THEORY
- NETWORK OPTIMIZATION STUDIES
- PROBABILISTIC MODELING

In addition to the cited professional status, staff members receive attractive salaries, up to four weeks vacation, generous insurance and retirement benefits, and tuition paid graduate study. If you are interested in one of these professional opportunities, please reply in confidence to Mr. R. B. Martin.

ARMOUR RESEARCH FOUNDATION
OF ILLINOIS INSTITUTE OF TECHNOLOGY
TECHNOLOGY CENTER, CHICAGO 16, ILL.

CIRCLE 80 ON READER CARD

Battelle writers say . . .

Quality, Not Quantity

SEEKING to solve the information problem by increased use of machines is a quantitative concept which skirts the most important element in any information system – the user. The theory that we need to develop information centers based on qualitative not quantitative concepts was expresed by G. S. Simpson, Jr. and J. W. Murdock of the Battelle Institute in that organization's November (1960) Battelle Technical Review.

They reject the conventional idea that the best way to cope with the information problem is to concentrate on the use of computers, data processing machinery, reproduction and transmitting machines, and similar equipment.

They contend that all a machine can do is to provide the researcher either with copies of abstracts and articles or with an overwhelming list of references to books, papers, articles and reports – all of which are recalled from storage through a code foreign to the researcher's thought process. These publications must then be reviewed by the researcher, who then will have to eliminate the out-of-date, inapplicable, and redundant information.

They propose a two-fold approach to provide the researcher with the information he needs in a form he can use:

First, the literature received by an information center should be continuously screened and evaluated by the scientists and research-engineers who use it. In this way, not only does the user accept a new responsibility with respect to scientific literature, but his own specialized knowledge also serves as qualitative filter because of his more intimate knowledge of the vagaries of the information.

Second, to obtain a thorough knowledge of the state of the art in a particular area, the published information should be supplemented with information gained from such sources as discussions, conferences, letters, and trips.

"A qualitative task," states Simpson and Murdock, "requires the efforts of knowledgeable people cooperating in a well-planned system. Once organized, such a system benefits the serious seekers of information and spares them from fighting the rising tide of publications."

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CIRCLE 82 ON READER CARD

ACM Announces Call For Papers

THE SIXTEENTH National Conference of the Association for Computing Machinery will be held at the Statler Hotel, Los Angeles, on September 5-8. Local arrangements will be under the direction of Ben Handy, Litton Systems, Inc.

Contributed papers concerned with all phases of analog and digital computation, business applications, and data processing are solicited. Each person wishing to contribute a paper to the program is requested to send to the Program Committee by May 1st, four copies of both a 100-word abstract and a four-page summary. The abstract should be suitable for inclusion in the printed program of the meeting, while the summary will be published in the conference preprints. These preprints will be available at the time of the meeting.

Since the number of contributed papers that can be accepted is limited to the conference time schedule, some selection may be required. Papers submitted should have a specific title; both abstracts and summaries should be identified by author and affiliation. In addition, it is requested that the author select one or more of the suggested subject areas, under which his talk can be suitably classified. The papers should be sent to Werner L. Frank, Ramo-Wooldridge, 8433 Fallbrook Ave., Canoga Park, Calif.

The program will include a substantial number of invited papers, survey talks, roundtable discussions, and a "Hall of Discussions."

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Note: You're invited to meet with representatives of the Computer Department at the Western Joint Computer Conference, May 9-10-11 in Los Angeles.

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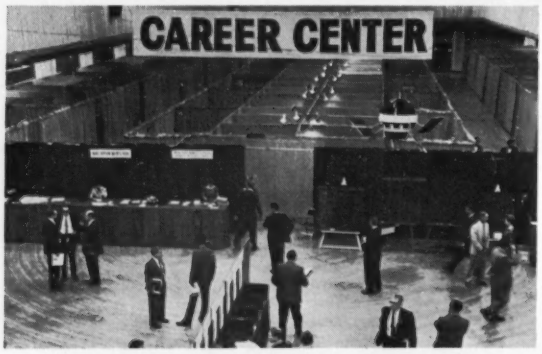

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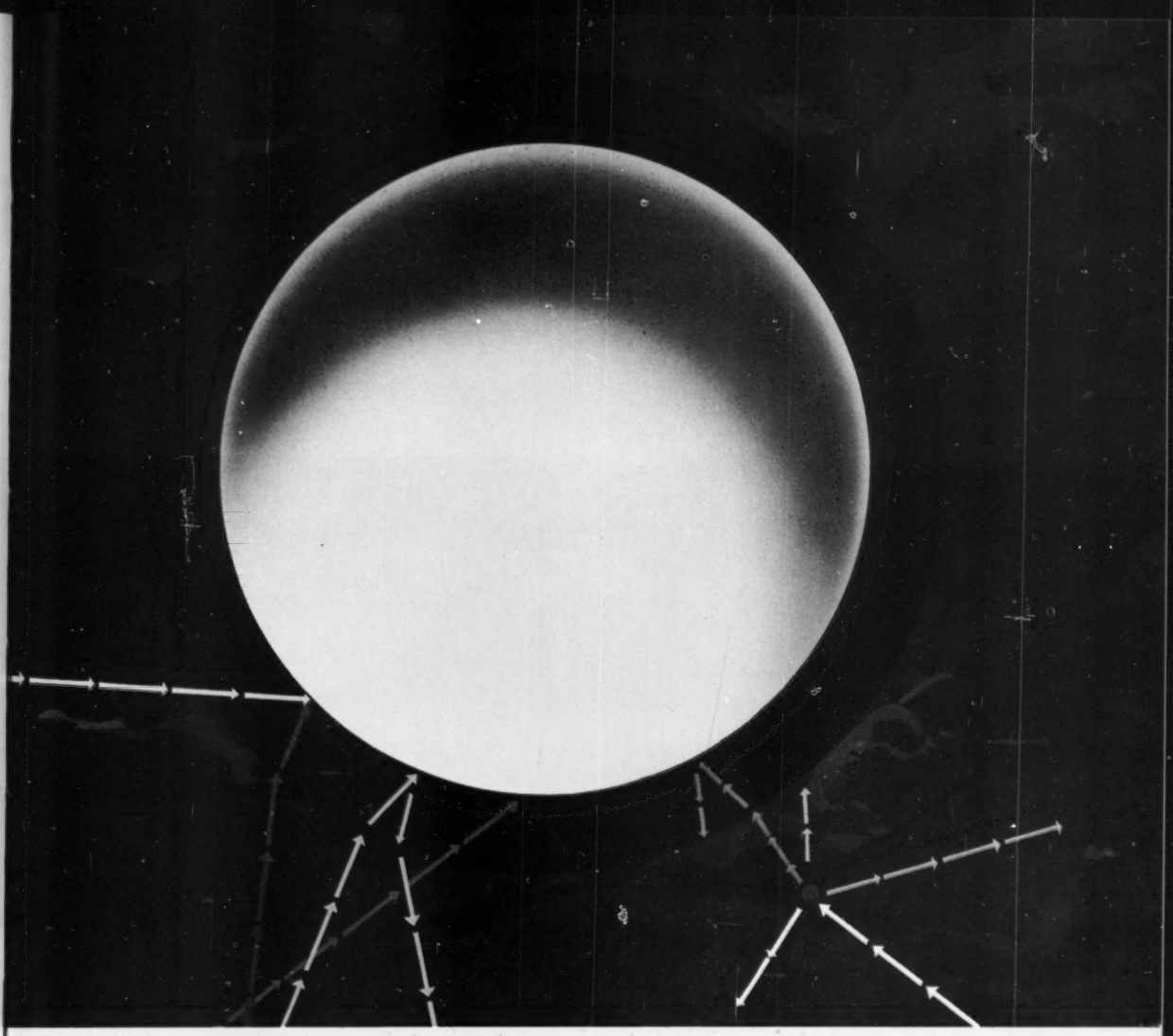

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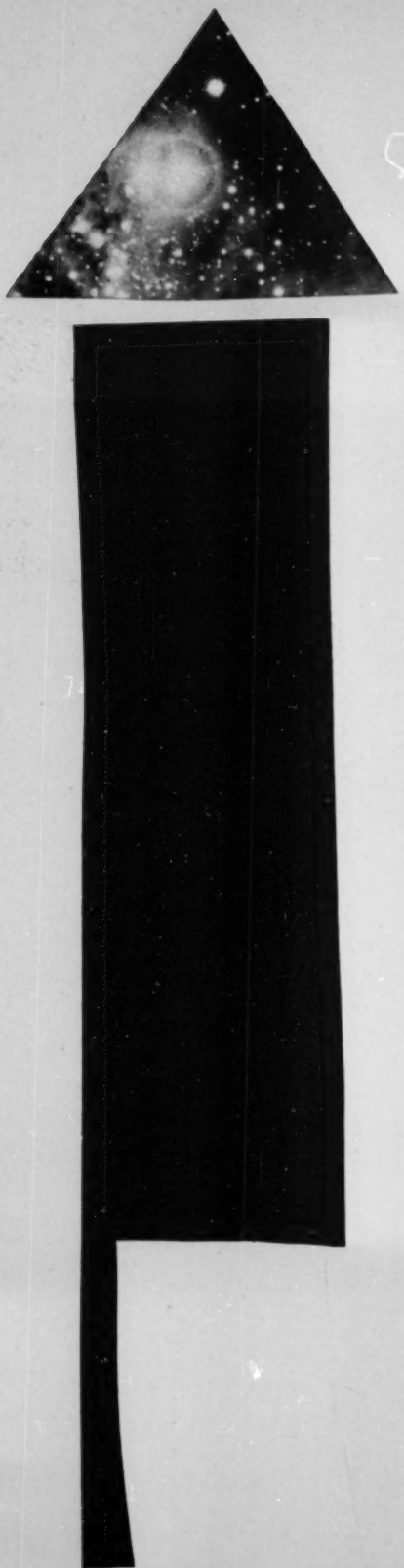

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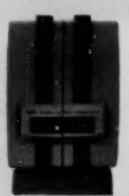

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